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Heritage Consultants

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Godden Mackay Logan Pty Ltd (ACN 001 179 362) 78 George Street Redfern Sydney Australia 2016. Ph +61 2 9319 4811

Waddamana Power Stations

Conservation Management Plan

Report prepared for Hydro Tasmania

June 2006

Report Register

The following report register documents the development and issue of the report entitled Waddamana Power Stations—Conservation Management Plan, undertaken by Godden Mackay Logan Pty Ltd in accordance with its quality management system. Godden Mackay Logan operates under a quality management system which has been certified as complying with the Australian/New Zealand Standard for quality management systems AS/NZS ISO 9001:2000.

Job No./Ref	Issue No.	Notes/Description	Issue Date
06-0018	1	Draft Report	May 2006
06-0018	2	Final Report	June 2006

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Conservation Management Plan

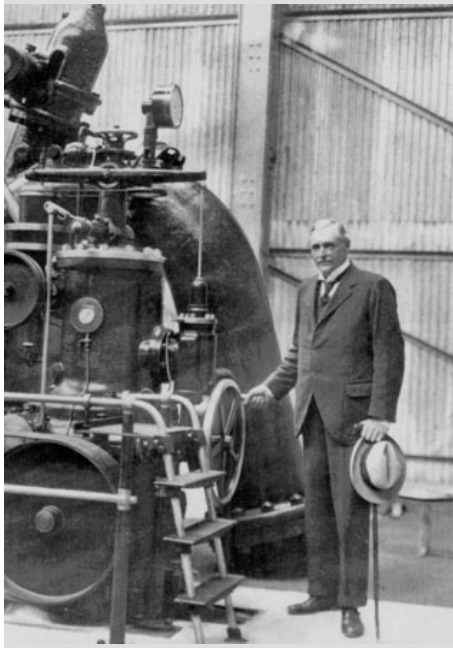
Executive Summary

This Conservation Management Plan covers Waddamana A and Waddamana B Power Stations which were part of the original Great Lakes Scheme. The Great Lakes Scheme was a private venture by the Hydro-Electric Power and Metallurgical Company, commenced in 1908, which had got into financial difficulties in 1914. Waddamana A became the first power station operated by the organisation which became the Hydro-Electric Commission when the project was taken over by the Tasmanian Government in 1914.

The Power Station's generating capacity was increased in 1919 and then in 1922–23, the plant's capacity was increased to 49,00kw by the addition of six new turbines and generators. This enabled power to be supplied to domestic and industrial users in Hobart and Launceston. Waddamana A was the main source of power until Shannon and Tarraleah Power Stations came on line from the mid-1930s.

Waddamana B was first proposed in 1929 to double the capacity of Waddamana A but was deferred until the late 1930s when the push for more power for industrial development began. Construction occurred during World War II and the immediate postwar period.

Waddamana A was closed in 1965 but was reused as a museum from 1988. Waddamana B was kept in service until 1995 when it was closed. Currently, it is occasionally used for storage. Both sites contain well preserved examples of the technology of hydro-electric power generation. There is also a large collection of archival documents and movable cultural material items. Two databases accompany this report—Appendix A provides built heritage data sheets for the site; Appendix B provides a moveable heritage audit (of larger items).



Statement of Historic Cultural Heritage Significance

A statement of historic cultural heritage significance was prepared as part of this study, as follows:

The Waddamana study area and the whole Great Lakes Scheme demonstrate a key part of Tasmania's history, namely the development and exploitation of Tasmania's hydro resources to provide cheap power for domestic and, more importantly, for industrial use. From 1916 until 1934, Waddamana was the sole power station supplying the bulk of power to Tasmania's industry and, from 1934 until the 1950s, Waddamana still provided a significant amount of hydro power generated. Waddamana A was still contributing 17% of the overall power produced in Tasmania when it was closed.

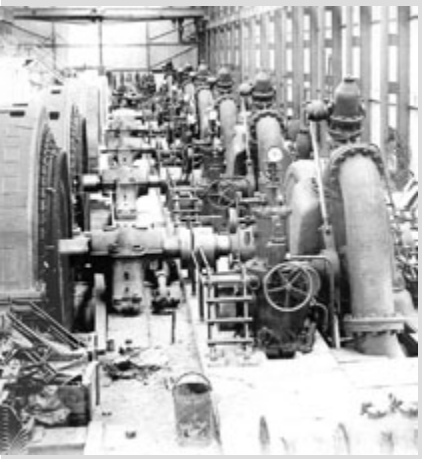
The difficulties the Hydro-Electric Power and Metallurgical Company experienced in constructing the project led to the involvement of the Tasmanian Government in the provision of electricity and the creation of the Hydro-electric Department (later the Hydro-electric Commission and, in due course, Hydro Tasmania).

The construction of Waddamana B Power Station was the direct result of linking Tasmanian politics with the development of hydro-electricity in the 1934 state election. This linking led to the construction of Tarraleah and Waddamana B. The history of the construction of Waddamana B demonstrates the difficulty in undertaking a large engineering project during a world war.

The numerous items of technology, such as the inlet valves, turbines and generators, for example, contained in the Waddamana study area are rare, largely because only a few such items were ever in use. The Waddamana study area is important because it demonstrates the key characteristics of a hydro-electric power station from the first half of the twentieth century. Waddamana A is virtually complete and very close to its original fit out. Waddamana B is less complete but the key elements of the processes and machinery are still in situ, making it possible to demonstrate how the plant worked when commissioned and, by comparing the two power stations, it is possible to demonstrate changes in technology in the years between the completion of Waddamana A and Waddamana B.

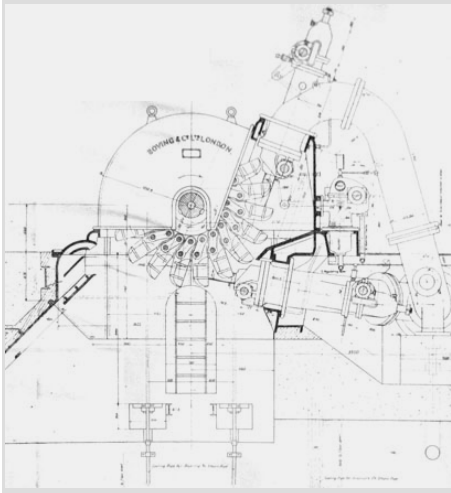
The formal entrance to Waddamana A and the timber construction of the engineers' offices, lookout, stairs and control room are unique in an industrial context and are, therefore, a unique part of Tasmania's heritage.

The Waddamana study area has considerable potential to yield information that contributes to the understanding of Tasmanian history. The principles of electricity and its generation, the development of electrical technology and the impact that electricity has had on Tasmania over time can be demonstrated through the interpretation of Waddamana A and Waddamana B (including the movable cultural heritage items).



The Waddamana study area has a special meaning to members of the community who worked for Hydro Tasmania (and its antecedent organisations) at the stations and because it was the first hydro-electric power station owned and operated by Hydro Tasmania. The Waddamana study area also has a special meaning to members of the Institution of Engineers who awarded the Waddamana A Power Station an Australian Historic Engineering Plaque.

The Waddamana study area has a specific association with the life and work of Sir John Butters, the first engineer involved in the design and construction of the Great Lakes Scheme when it was in private hands and who later became head of the Hydro-Electric Department when the Tasmanian Government took over the scheme. Butters had a direct 'hands-on' involvement with the Waddamana study area as the engineer involved in the project design.



It is concluded that as the Waddamana study area meets all the historical cultural heritage significance criteria at a number of levels, the study area has a high level of historical cultural heritage significance to Tasmania.

A search of the Australian Heritage Places directory on 8 May 2006 indicated that there were no Commonwealth or Tasmanian listings for the Waddamana Power Stations. However, the heritage significance of Waddamana A Power Station was recognised when it was awarded a National Engineering Landmark plaque under the Australian Historic Engineering Plaquing Program in February 1995. This recognised that Waddamana A was of State, National and International heritage significance.

Conservation Policy

Eight general conservation polices were developed in this report based on an analysis of the constraints and opportunities pertaining to the Waddamana study area. These policies are set out below and discussed in Section 7.0.

Policy 1 The Waddamana study area (excluding Precinct 6) should be considered in ongoing discussions between Hydro Tasmania and the Tasmanian Heritage Council for listing on the Tasmanian Heritage Register and for the establishment of heritage agreements for the on-going use of the study area.

Policy 2 The Waddamana study area should be conserved and managed in accordance with the guidelines and philosophy of *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 1999* and such guidelines issued by Heritage Tasmania and Hydro Tasmania.

Policy 3 An overall manager or management team within Hydro Tasmania is needed to manage the Waddamana study area.

Policy 4 The current use of the precincts in the study area, in particular the use of Waddamana A as a museum and the plan to mothball Waddamana B, are appropriate and should continue.

Policy 5 All potentially hazardous materials in the Waddamana study area need to be identified and managed appropriately.

Policy 6 An on-going program of cyclical maintenance should be established by Hydro Tasmania.

Policy 7 The current interpretation of the study area, while adequate, needs to be developed to make the best use of the Waddamana study area.

Policy 8 The Conservation Management Plan for the Waddamana study area should be formally endorsed by Hydro Tasmania as the guiding document for future management and conservation of the Waddamana study area. The Conservation Management Plan should be reviewed in five years to ensure its relevance.

Detailed policies for each of the six precincts in the Waddamana study area are outlined. Implementation strategies are presented in Section 8.0.

1.0 Introduction

1.1 Background to this Project

In 2004–05, as part of Hydro-Tasmania's Cultural Heritage Program, Paul Davies Pty Ltd prepared an overall heritage study of Hydro Tasmania's heritage assets. As part of this program, it was recognised that several power stations required Conservation Management Plans to be prepared in order that their heritage value was fully identified and managed appropriately. Plans have been prepared for Lake Margaret, Tungatinah and Tarraleah Power Stations. It was recommended in the Davies report that a Conservation Management Plan be prepared for Waddamana A and Waddamana B power stations.

This Conservation Management Plan covers Waddamana A and Waddamana B Power Stations which were part of the Great Lakes hydro-electric scheme (Figure 1.1). Waddamana A was the first power station operated by the organisation that became the Hydro-Electric Commission when the project was taken over by the Tasmanian Government in 1914. Waddamana B was constructed during World War II and the immediate postwar period.

1.2 The Study Area

The study area is both the Waddamana Power Stations and the adjacent land owned by Hydro Tasmania. The area is generally shown in Figure 1.2 and more specifically in Figure 1.3. In discussion with the Project Manager, Sarah Waight, it was agreed that the tailrace from Waddamana A Power Station should be included in the Conservation Management Plan, although it is located on an easement owned by others. In this Conservation Management Plan, the study area is referred to as the 'Waddamana study area'.

1.3 Heritage Listings

A search of the Australian Heritage Places directory on 8 May 2006 indicated that there were no Commonwealth or Tasmanian listings for the Waddamana Power Stations. However, the heritage significance of Waddamana A Power Station was recognised when it was awarded a National Engineering Landmark plaque under the Australian Historic Engineering Plaquing Program in February 1995. This type of plaque is awarded by the Institution of Engineers for sites of a State, National and International heritage significance.

1.4 Methodology

This Conservation Management Plan has been prepared in accordance with the principles of *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 1999* and associated guidelines which contain principles for the conservation of significant places and the preparation of Conservation Management Plans.

1.5 Limitations

Some areas of the Waddamana study area were not physically inspected either because they were inaccessible or because inspection would have been hazardous.

This Conservation Management Plan does not consider issues relating to Indigenous heritage.

1.6 Author Identification

This Conservation Management Plan was prepared by Dr Iain Stuart and Jane Cummins Stuart from JCIS Consultants for Godden Mackay Logan Pty Ltd. The Conservation Management Plan was reviewed and edited by Professor Richard Mackay, AM, Director of Godden Mackay Logan.

1.7 Acknowledgements

The following people have assisted in the preparation of this Conservation Management Plan:

- Sarah Waight, Senior Environment Consultant (Heritage), Hydro Tasmania Consulting.
- Sandra Hogue, Senior Environment Consultant and Cultural Heritage Program Manager, Hydro Tasmania Consulting.
- Helen Brain, External Communications Officer, Hydro Tasmania.
- Andrew Scanlon, Environments and Sustainability Manager, Hydro Tasmania.
- David Thomas, Land and Facilities Manager, Hydro Tasmania.
- Margo Graeme-Evans, Information Officer, Hydro Tasmania.
- John Marriott, Information Officer, Hydro Tasmania.
- John Sullivan, HSSE & Bus Sys Coordinator, Hydro Tasmania
- Heather Felton, Project Officer—Oral History, Hydro Tasmania.
- Frank Cooper, Contractor and Curator, Waddamana Power Station Museum.
- Helen Cooper, Contractor and Curator, Waddamana Power Station Museum.
- John Hardstaff, Volunteer Curator, Waddamana Power Station Museum.

Figure 1.1 Map of Tasmania showing Waddamana.

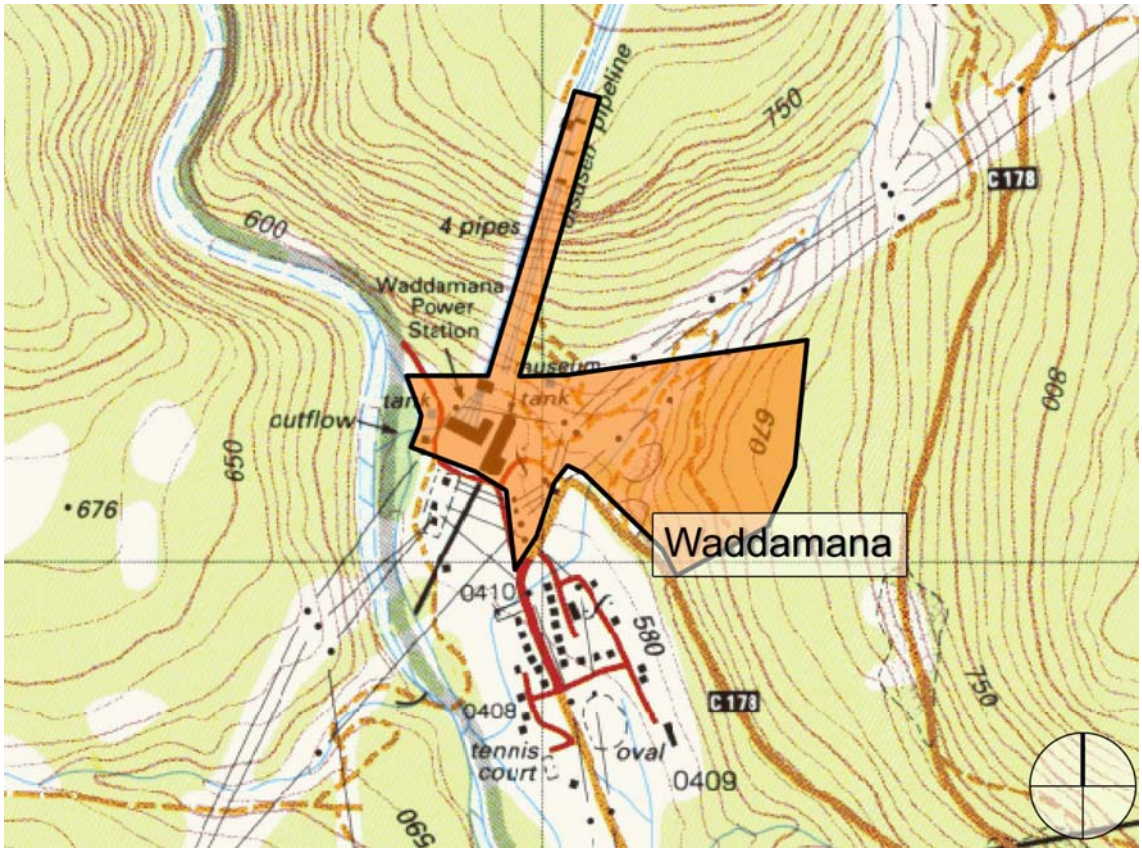


Figure 1.2 The Waddamana study area (courtesy of Hydro Tasmania).

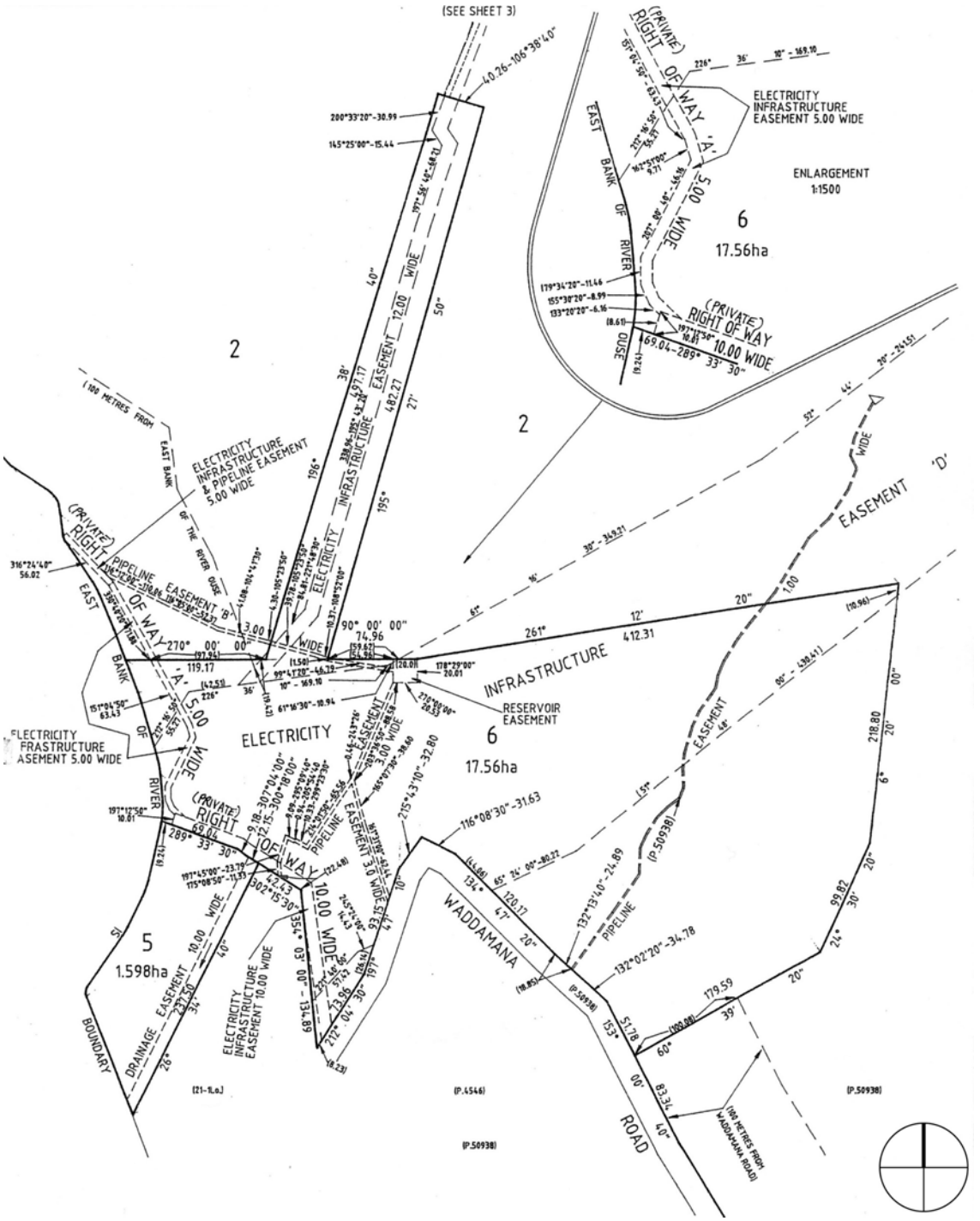


Figure 1.3 Waddamana Power Station study area boundaries. (Plan of Survey Annexure Sheet SP 133339, 4/4/99)

2.0 Historical Overview

2.1 Origins of the Project

The principles of hydro-electricity generation were well known in Tasmania prior to the construction of the first Waddamana Power Station through hydro-electric plants at Waratah (1893) and Duck Reach (1895). However, as Gilbert points out, these were local schemes; it was not until 1907 that the problems of distributing the electricity were solved through the adoption of high voltage alternating current transmission lines. This allowed a state wide system of hydro-electric supply to be contemplated.[1] Newspaper articles in 1905 identified the potential of the Waddamana area and outlined what would become known as the 'Great Lakes Scheme'.[2]

A critical factor in providing the impetus for the scheme was the Complex Ores Company. The Complex Ores Company was run by the metallurgist James H Gillies, who was one of the many metallurgists working on the problem of refining and smelting the complex ores at Broken Hill and had patented a process for the electrolytic refining of zinc.[3] Gillies had apparently established a pilot plant in Richmond, Victoria but needed a better location with good access to a port and to ample supplies of electricity. Gillies raised capital in the form of the Gillies Sulphide Concentrating Company (later the Complex Ores Company) and was touring Tasmania in 1908 when he met with the Premier of Tasmania, John Evans. Evans organised a meeting with Professor Alexander McAulay (a mathematics lecturer) and Mr Brettingham-More (an engineer), who were advocates for the Great Lakes Scheme.[4]

Gillies inspected the Great Lakes and Waddamana in company with the Surveyor General of Tasmania and others, and he was supplied with data on the potential output of the scheme. Gillies was impressed with the idea and proposed that either the Government develop the scheme and supply power to Complex Ores or that the Government allow Complex Ores to undertake the project at their risk.[5] Not surprisingly, the Government preferred the latter approach and passed the *Complex Ores Act 1909*.

The provisions of the Complex Ores Act allowed the extraction of waters from the Great Lake, and construction of the dams, penstocks, power station, sub-stations and transmission lines. It allowed the company to sell electricity to any local authority and any company or person residing outside a radius of 10 miles from Launceston (this provision preserved the monopoly of Launceston Council's

[1] Gilbert, H de V 1998, *The Great Lake (Waddamana 'A') Power Development in Tasmania 1910–1965, Origins and Working History*, paper presented to the 9th Australian Conference on Engineering Heritage, p 1 (copy supplied by Hydro Tasmania Library).
[2] Robson, L 1991, *A History of Tasmania: Volume II Colony and State from 1856 to the 1980s*, Melbourne, Oxford University Press, p 295.
[3] Gillies, however, was not a major player and his plant was never adopted by any of the Broken Hill Mines.
[4] Gilbert, op cit, p 1.
[5] Robson, op cit.

Duck Reach Power Station). The Act required the Company to build both the Power Station and the treatment works at Hobart within four years.[6]

The Complex Ore Company floated another company, the Hydro-Electric Power and Metallurgical Company, to run the project. The Hydro-Electric Power and Metallurgical Company retained the world leaders in power system design, the London-based Messrs Merz and McLellan, as their consultant engineers. However, the engineering talent behind the scheme was John Henry Butters.[7]

Butters was an electrical engineer by training. His training involved graduating with a certificate at the University of Southampton and an engineering apprenticeship with Thornycroft.[8] In 1905, he joined Siemens Brothers[9] and, after four years, he was offered the position of Chief Engineer in their Melbourne Office. In Melbourne he had Australia-wide responsibility for design and in 1910, he advised on a hydro-electric scheme at Hira Hora in New Zealand. Butters was also asked to report on the Great Lakes Scheme by Gillies and it was Butters' favourable report that was used by the Hydro-Electric Power and Metallurgical Company to raise £200,000 in capital.[10]

The scheme involved the construction of a dam on the comparatively shallow Great Lake at Miena where the Shannon River originated. From the Dam, the water was flowed into the course of the Shannon River. After five miles, the river was diverted by a weir into a canal which supplied an artificial lake—the Penstock Lagoon, formed by levee banks around a natural depression. From the Penstock Lagoon, the water travelled by penstocks to the Power Station at Waddamana (Figure 2.1). From the Waddamana Power Station, the electricity was subsequently transmitted by high voltage transmission line to a sub-station at Hobart for distribution.

2.2 Initial Construction of Waddamana A 1910–1913

Construction started in October 1910, with the formal turning of the first sod by Mrs McAulay to begin construction of the canal between the dam and Penstock Lagoon. Butters resigned from Sieman's Bros and joined the Hydro-Electric Power and Metallurgical Company as Engineer-in Chief in August 1911, and soon after was sent to the USA and the UK to order plant and equipment.

The Company apparently had underestimated the difficulty in undertaking construction work in such an undeveloped area. As there was no direct access to Waddamana, all the machinery, steelwork, pipes and cement had to be transported by horse-drawn trucks running on a wooden tramway. In addition, the winter of 1912 was the worst on record and caused all work to cease for several

[6] Robson, op cit, pp 295–296.
[7] Often high profile engineers were attached to a project and did little more than sign drawings prepared by the engineers on the spot.
[8] This was typical training for an electrical engineer at the time; the author's grandfather had a similar training around that time.
[9] In 1881, a Siemens water-powered AC alternator was used to power the world's first street lighting in Godalming, United Kingdom.
[10] Butters, JWW, *The Life and Time of John Henry Butters, the first Sir John Butters Oration*, Canberra Division of the Institution of Engineers 14th October 1985; the raising of capital was no easy matter, see Robson, op cit, pp 296–297.

months. The collapse of the world zinc price made it difficult to raise further capital.[11] Desperate to raise money, the Company sold its Hobart distribution system to the Hobart Gas Company in 1913 for £18,000.[12] The Tasmanian Government refused to support the Hydro-Electric Power and Metallurgical Company so work ceased in 1914, when the company went into receivership.[13]

2.3 State Ownership (Origins of the Hydro-Electricity Commission)

The Tasmanian Government looked carefully into the question of acquiring the assets of the Company and sought advice from a Mr Parry, Engineer in Charge of the New Zealand Hydro-Electric Department. He inspected the scheme and advised that it was well designed and constructed. Much of the difficult construction work was paid for and the machinery manufactured and ready for delivery. There were three major clients looking to sign bulk contracts for power and a completed domestic distribution system was in place.[14] In October 1914, the newly elected Earle Labour Government purchased the scheme.[15]

A new government department, the Hydro-Electric Department, was established in August 1914 and managed the newly acquired assets. In December 1915, the government also purchased the electricity distribution assets of the Hobart Gas Company. Another asset acquired was John Butters, who was appointed Engineer in Chief and General Manager of the Hydro-Electric Department. Butters' task was to complete the project. This was made even more difficult by the impact of World War I on normal commercial trade. Materials were interned or were in short supply. Nevertheless, the scheme was ready for opening by May 1916.

The formal opening of the Great Lakes Power Scheme was something of a procession. The official party comprised some 18 persons including the Governor-General, the State Governor and associated past and present Premiers. They travelled on horseback to the Great Lake where a former Premier John Earle opened the sluice gates. The party then travelled to the intake on the Shannon River where Premier WH Lee opened the gates and diverted the water into the canal to Penstock Lagoon. At Penstock Lagoon, the State Governor Sir William Ellison-Macartney opened a valve to allow water to flow into the penstock. After resting overnight at the Waddamana Accommodation House, the Governor-General of Australia, Sir Ronald Munro-Ferguson, started No. 1 machine and switched power through to Hobart on 6 May 1916. The party then travelled to Hobart where the Governor-General switched the electricity from the Hobart sub-station to the main lights of the Town Hall (Figure 2.2).

[11] See Robson, op cit, p 296–299.
[12] Felton, H, Electricity for the Home, first draft manuscript, April 2006, p 1.
[13] Gilbert, op cit, p 2.
[14] According to Robson, Gillies plans to establish an electrolytic zinc works were thwarted by a rival consortium backed by the Colins House group which combined to form the Electrolytic Zinc Company leaving the Complex Ore Company with a carbide works located at North West Bay, Robson, op cit, pp 298–299.
[15] Robson, op cit, p 298.

This somewhat elaborate and prolonged ceremony involving eminent dignitaries is an indication of how important the Great Lakes Power Scheme was seen at the time, as well as setting a precedent for elaborate opening ceremonies involving vice regal figures for most hydro developments. The involvement of the Governor-General is surely an indication that the Tasmanian Government saw the project in a national context.

The plant installed at Waddamana was as follows. At the station, water came in through 30 inch (750mm) diameter steel pipes to a 30 inch bus pipe with a valve between the turbine offtakes. The water drove two 5000hp Bovington single-jet, horizontal-shaft Pelton wheel turbines. These drove 4050KVA British Westinghouse alternators. Separate exciters were provided[16], these being two 120KWA 110volt British Westinghouse DC exciters coupled to a Bovington single-jet horizontal-turbines supplied from a 12 inch bus pipe which could be supplied from either 30 inch pipeline. The water exited the building through a tailrace to the Ouse River.

The AC current was sent to a 6.6/88kV transformer bank mounted inside the station. There were two 88kV Westinghouse oil circuit breakers with isolators also inside the building. The transmission line was 65 miles (105 km) long with 560 steel towers.[17]

The generating plant and switchyard was mostly contained within two buildings. The first, western building was a steel framed, almost square structure with a gable roof and a raised wooden ventilation strip along its ridge. The second building, abutted the first to east. The second building was a steel framed, almost square structure with a gable roof (ie it was almost the same shape as the first). This building had a bank of three windows on its southeastern face. Both buildings were clad and roofed with corrugated galvanised iron sheets. The buildings were entirely functional large tin sheds. The first building contained the turbines, generators and control rooms and the second, abutting the first to the southeast, contained the transformers and switches (Figure 2.3).

The plant had some teething troubles after opening but by 1917, the plant was supplying about 2000hp to Hobart for tramway, lighting and power and 3500hp to the Hydro-Electric Power and Metallurgical Company for their carbide works. With the establishment of the Electrolytic Zinc Company at Risdon, there was a further demand for power and the potential for further large purchases of power. Butters undertook the urgent expansion of generation capacity.[18]

The capacity of the Power Station was expanded by the addition of a Boving two jet 8000hp turbine coupled to a 7050KVA General Electric (USA) alternator. This was accomplished without any change in the external appearance of the Power Station. A second circuit was also put on the transmission towers.[19] This work was completed by 1919.

[16] These smaller generators generated the power to the electric magnets in the larger generators.
[17] Gilbert, op cit, p 3; also interpretation of various site plans and photographs.
[18] This expansion had already been provided for in the design of the plant; 'The Great Lakes Hydro-Electric Scheme, Tasmania', *Engineering*, 1924, p 356.
[19] Gilbert, op cit.

2.4 Expansion

Once the Power Station was up and running, there was a marked increase in demand for electricity, especially from domestic and small commercial users. There was also a growing requirement for the block purchase of electricity from the Electrolytic Zinc Company works at Risdon. This resulted in Butters initiating a major upgrade of the whole Great Lakes system from 1919 -1923 to supply electricity throughout north and south Tasmania. These works were lovingly described and illustrated in a series of reports in the respected British journal *Engineering* in 1924. The works constructed between 1919-1924 are described below based on the reports in *Engineering.*

The Great Lake Dam was replaced by a 40ft (12.2m) high dam, 1180 ft (359.7m) long constructed in 27 arches with four, manually-operated, cast iron sluice gates. Additional water into the Great Lake was provided by diverting water from the Ouse River via a 5.5 mile (8.9km) long canal—the Liawenee Canal.

A parallel canal between the Dam and Penstock Lagoon was excavated and a second chamber was constructed at the Penstock to take Penstocks to Waddamana. The pipelines were increased and a surge tank erected 3000ft (914.4m) south of the Penstock wall. A 24 inch gauge haulage ran up the steep slope from Waddamana to the Valve House and a 36 inch tramway ran between the Valve House and Penstock Lagoon.

At this time, the Waddamana Power Station was described as being a simple steel-framed building covered in corrugated galvanised iron and supported on concrete foundations. The foundations were described as consisting of blocks and piers of mass concrete under the machines and steel frames and connected by reinforced slabs and arches over three tunnels which run the length of the building. The three tunnels were used for the tailrace from the Pelton wheels, the hot air duct (outlet) and the cold air duct (inlet). The air circulated around the generators cooling them. All cables were encased in fibre ducts embedded in the concrete floor.[20]

A further six Boving two jet 8000hp turbines were installed coupled to 7050 KVA General Electric (USA) alternators. This required installation of 36 inch (914mm) pipes and valves to bring the water to the turbines. Two motor-driven 300KVA generator sets with Bruce Peebles motors and General Electric generators were provided as exciters; power was supplied from the bus bars.

The original controls were replaced by enclosed elevated concrete platforms containing bench boards and panels. Adjacent to these, but unenclosed, was the switch gallery containing circuit breakers.[21] The switch gallery was described as having an upper and lower floor. The upper floor contained 21 remote control General Electric 6,000 volt circuit breakers, which were in the circuit between the generators, and the bus bars, which were located in the lower floor of the switch gallery. The operation of the circuit breakers was from the adjacent control room.

[20] *Engineering*, op cit, p 595.
[21] Gilbert, op cit, pp 3–4.

The switchyard was established outside the Power Station with 23 Westinghouse single phase 6,600/88,000 volt transformers in seven transformer banks. The transformers were oil-insulated water-cooled. A piping system allowed the oil to be drawn off to a 900 gallon storage tank in the basement for filtering.[22]

From the transformers, the current went to 88,000 volt busses through remote controlled oil switches there were also disconnecting switched and a horn gap. This allowed the flow of current to be directed into the transmission line, as well as allowing testing of the circuit without stopping the flow of electricity. There were five, increased to six, transmission lines installed; most ran to Hobart but one ran north to Launceston.[23]

The original building containing the turbines was extended to the northeast to enclose the new turbines and associated equipment (Figure 2.5). It is likely that the 30 ton overhead electric crane was installed at this time. The roof of the building was pitched and contained skylights along its length.

The second tin shed was demolished and the transformers moved into the new switchyard. In its place, a smaller steel-framed building was constructed with its main axis running at 90 degrees to the main building. This annex housed the workshop, facilities for repairing transformers, stores room and the sling room. The second storey contained offices for engineers and other staff. There was an elaborate entrance and façade on this building.

As each turbine was installed, minor visits by dignitaries were organised to celebrate their opening. Although the building was opened in 1922, the ninth (and last) turbine was started in 1923. The ninth turbine was opened by the Governor-General of Australia, Lord Foster, on 19 January 1923.[24] The total installed horse power at Waddamana was 63,000hp, generating 49,000 Kilowatts. This brought to a close the period of major improvement of the Great Lakes Scheme (Figures 2.6 and 2.7). Butters left the Hydro-Electric Department in late 1924 to become Chief Commissioner of the Federal Capital Commission.[25]

There were further works to extract more power out of the system to meet the increasing demand for power (Figure 2.8). The largest of these was the construction of Shannon Power Station, first approved in 1923 but constructed in 1931–34. This Power Station was established between the Great Lakes Dam and Penstock Lagoon. Shannon was equipped with two English Electric horizontal turbo-alternators of 5,830KVA capacity driven by Francis turbines, and was opened on 1 May 1934.[26]

[22] *Engineering*, op cit.
[23] Ibid.
[24] Chapter 2, The Development Years, p 21.
[25] Butters, op cit, p 7.
[26] The date of opening is unclear.

2.5 Construction of Waddamana B

Although the Hydro-Electricity Department was investigating other schemes, notably the Upper Derwent Valley scheme, pre-tendering information was circulated to relevant companies for turbines for another Power Station at Waddamana in 1929. The intention was to establish a station adjacent to Waddamana and operate it from a control room also at Waddamana. The Hydro-Electric Department sought costs for units of 8,000, 15,000 and 20,000hp. The letters were issued in October 1929 and it is clear from responses in the file that work was put off, although companies continued to send information to the Hydro-Electric Commission.[27]

During the 1930s, the provision of hydro-electric power became a political issue with the 1934 election being fought over the construction of the Upper Derwent Scheme and the linking of the provision of 'cheap' hydro power with economic prosperity for Tasmania. The Upper Derwent Scheme was approved in 1934. Construction on Tarraleah Power Station commenced in June 1935, and the station was formally opened on 25 February 1938.[28]

In May 1939, Premier Ogilvie announced plans to expand Tarraleah with the addition of two more machines, and a month later for the second Power Station at Waddamana.[29] Orders were placed through Siemans (Aust) for English Electric turbines and generators in January 1940. The plant ordered was described as follows:

> *2 Water driven Generating sets … each set comprising one 16,700 brake horsepower, four jet, single casing, double wheel impulse turbine … directly coupled to one 16,000 KVA … 11,000 volt, three-phase, 80 cycle, 500 RPM horizontal shaft alternator … including main and pilot exciters.*[30]

These units were the same as the two ordered for Tarraleah earlier in 1939.

It seems very optimistic to place such orders during a World War but in January 1940, matters were not as drastic for the British as they were to be later that year. Indeed, the Hydro-Electricity Commission explained their order as an act of patriotism in maintaining British exports.[31]

Severe shortages of raw material, skilled personnel and transport delayed the production of the turbine and generator sets. Some vital components seem to have arrived on a very circuitous route from Switzerland. The steel pipes for the penstocks were made in Australia by Hume Steel Ltd and the fabrication, erection and painting of the structural steel work was done by Russell Allport Co from Hobart.

Construction seems to have commenced in 1941. By 1942, there were over 100 men working at Waddamana on construction of the Waddamana B Power Station. At the same time, the roof of

[27] See Waddamana B Project Generally, DX8-14, 1929–1957, AA520/106.
[28] Parham, D 2006, Tarraleah Power Station Conservation Management Plan, report by Austral Archaeology Pty Ltd to Hydro Tasmania, pp 8–9.
[29] Parham, op cit, p 25.
[30] See Generally Turbines Waddamana Power Station Siemans, PG-409, TJN1321.
[31] Annual Report of the Hydro-Electric Commission for 1939–40; the frustratingly detailed description of the construction of Waddamana B was not included in the Annual Reports for security reasons.

Waddamana A Power Station was camouflaged. It seems that some of the manpower was provided by the Civil Construction Corps through the Allied Works Council, as Waddamana was seen as wartime priority works. However, not all were skilled and there were tensions between them and HEC staff living at Waddamana Village.

The decision to add an additional turbine and generator set was made in May 1942 and by 1943, the decision had been made to install a further generator, doubling the size of the original plant. There were, however, issues to do with the quality of workmanship due to the lack of skilled staff. The first turbine was working by 1944 and the last was complete by 1949. In addition to the construction work at Waddamana B, the control room at Waddamana A was expanded to take the controls for operating Waddamana B (Figures 2.8, 2.9 and 2.10).

The plant at Waddamana B was similar to that installed in the expanded Tarraleah Power Station. It consisted of four 16,700 brake horsepower, four jet, single casing, double wheel impulse turbine directly coupled to one 16,000KVA 11,000 volt, three-phase, 80 cycle, 500RPM horizontal shaft alternator, and an exciter coupled to the end of the shaft. The plant was manufactured by English Electric on behalf of Siemens (Aust).

A plan and section of Waddamana B is shown in Figures 2.11 and 2.12.

2.6 Closure

The closure of Waddamana A was the result of the wearing out of the plant and the commissioning of the Poatina Power Station, which also drew water from the Great Lake and was more efficient. Waddamana A was closed in 1965 but the control station for Waddamana B still operated until 1994 when Waddamana B was closed.

In 1988, following assistance from the Australian Bicentennial Authority, the Hydro-Electric Commission opened a museum at Waddamana A.

2.7 Historical Development

2.7.1 Summary

A table of the key events in the history of the Waddamana study area is provided below (Table 2.1).

Table 2.1 Key events in the history of the Waddamana study area.

Year	Month	Event
1904–05		Hydro-Electric potential of the Great Lakes discussed in Tasmanian press.
1908		JH Gillies visits Tasmania and the Great Lakes.
1909		*Complex Ores Act 1909* passed.
1910	October	Construction work commences.
1911	August	JH Butters joins the Hydro-Electric Power and Metallurgical Company as Engineer-in-Chief.
1912	winter	Severe weather forces construction work to cease.
1914		Hydro-Electric Power and Metallurgical Company in receivership.
1914	August	Hydro-Electric Department formed.
1914	October	Assets of Hydro-Electric Power and Metallurgical Company acquired by Tasmanian government.
1916	May	Opening of the Great Lakes Scheme.
1919		Expansion of Waddamana A.
1919–1923		Major expansion of the Great Lakes Scheme.
1929		Planning begins for Waddamana B.
1939	June	Waddamana B formally announced as a project.
1940	January	Tender of Siemans (Aust) accepted.
1941		Construction works at Waddamana B commenced.
1944	January	First turbine at Waddamana B operational.
1949	June	Waddamana B opens.
1965		Waddamana A closes.
1988		Waddamana A opens as a Museum
1994		Waddamana B closes.

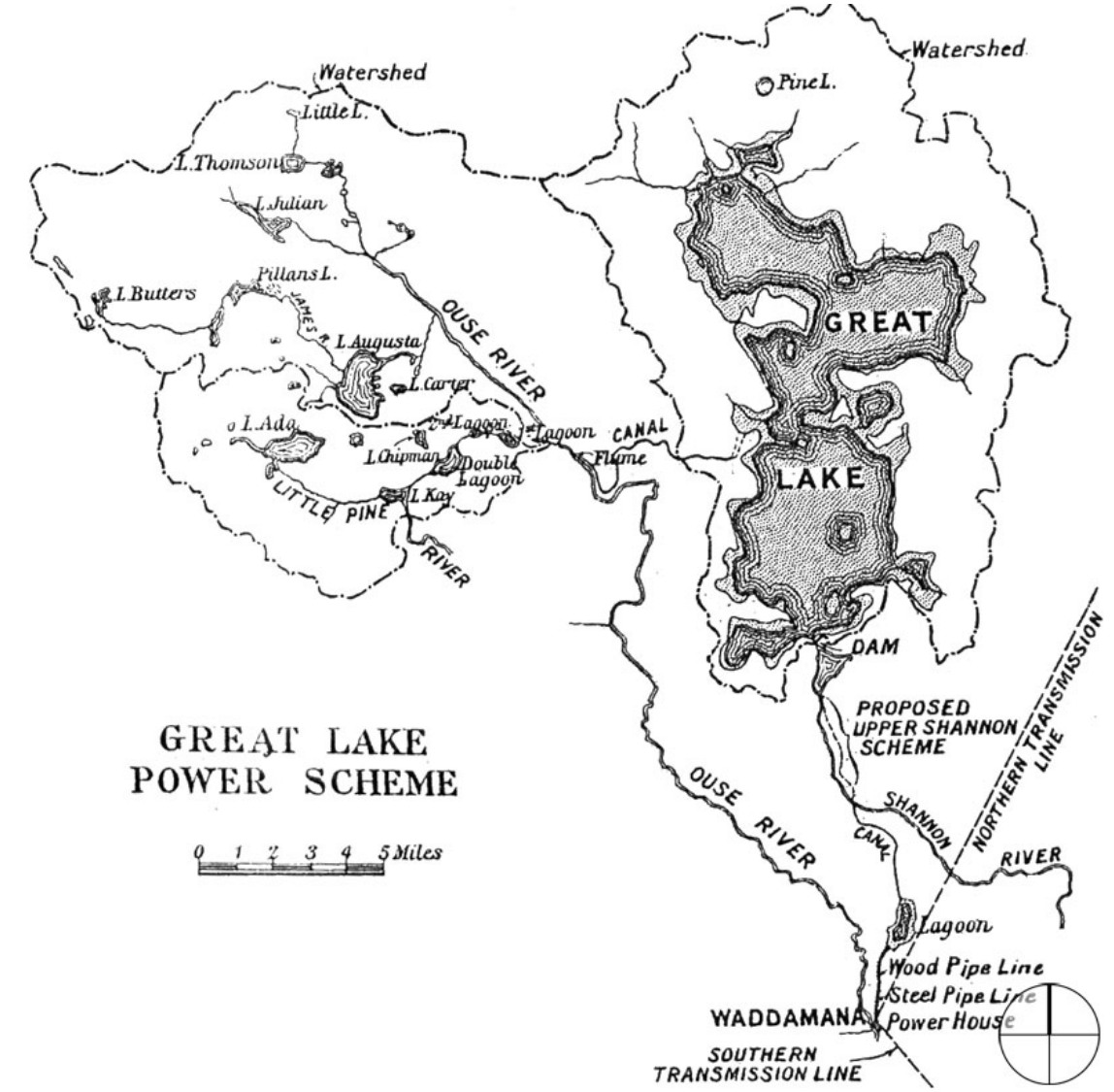


Figure 2.1 Plan of the Great Lakes scheme 1924 (*Engineering* 1924).

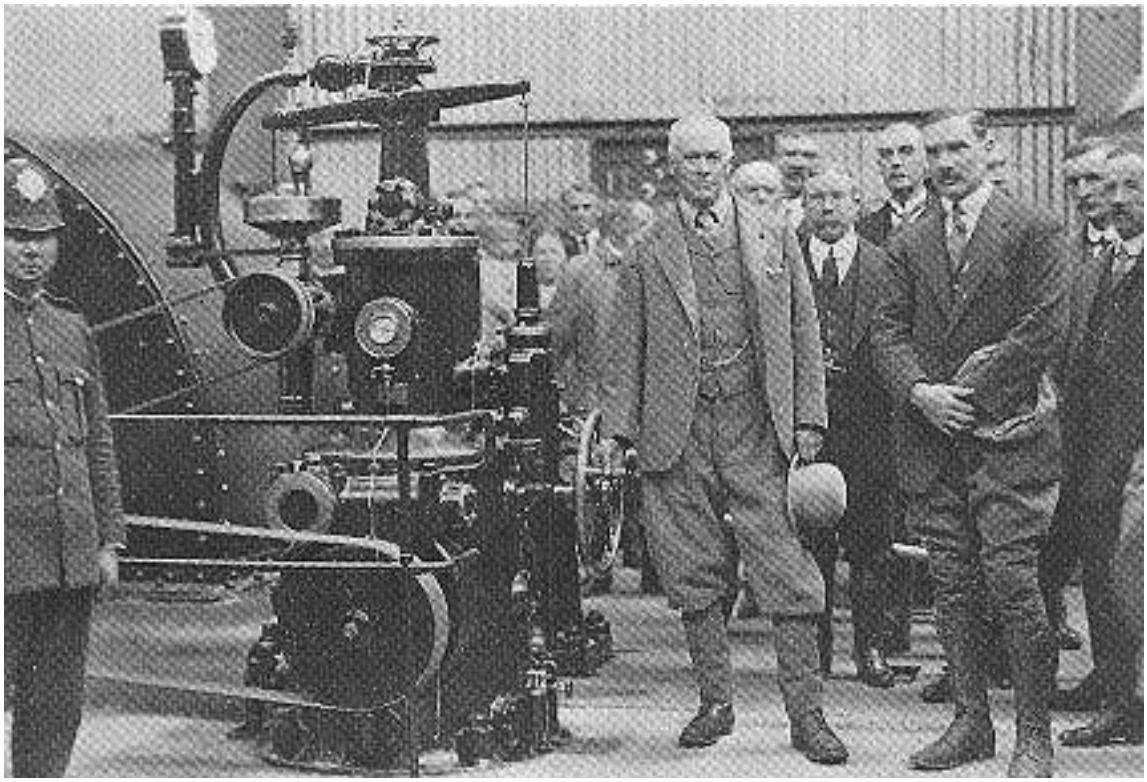


Figure 2.2 Sir Ronald Craufurd Munro-Ferguson turns on the first turbine on 6 May 1916 (Hydro Tasmania).

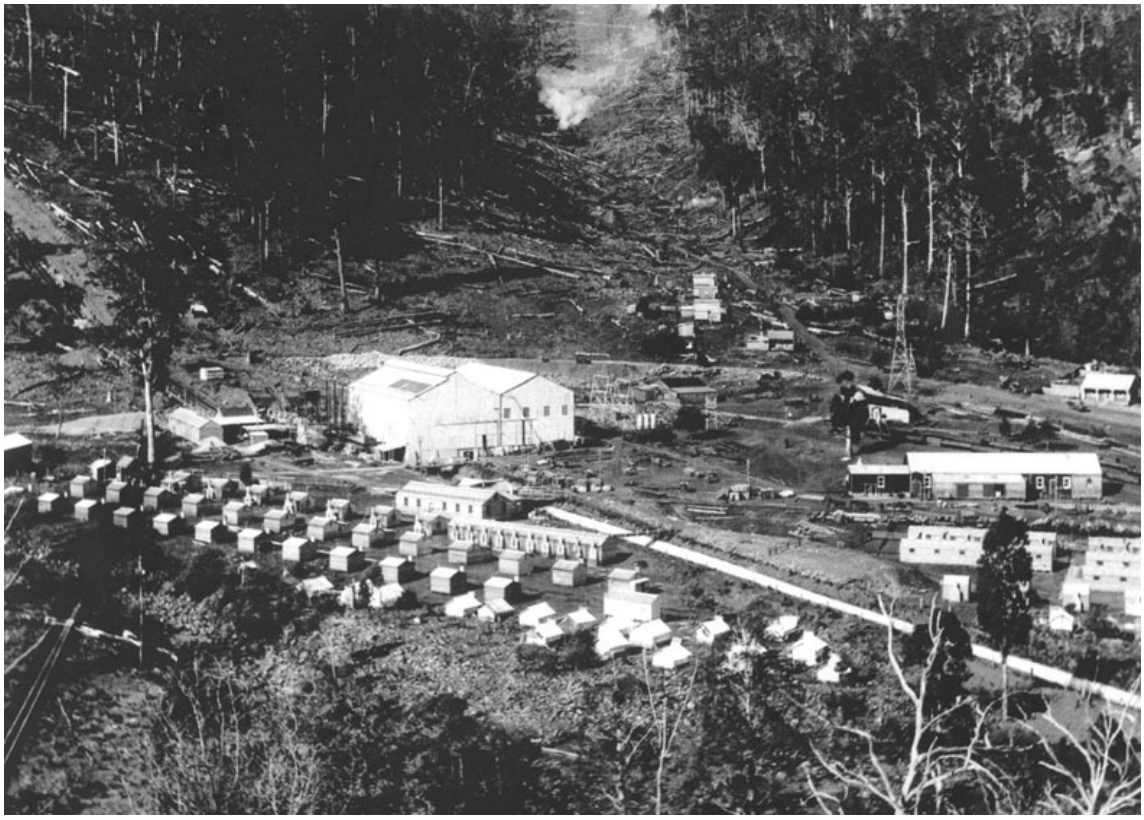


Figure 2.3 The Waddamana Powerhouse 1919 (Hydro Tasmania).

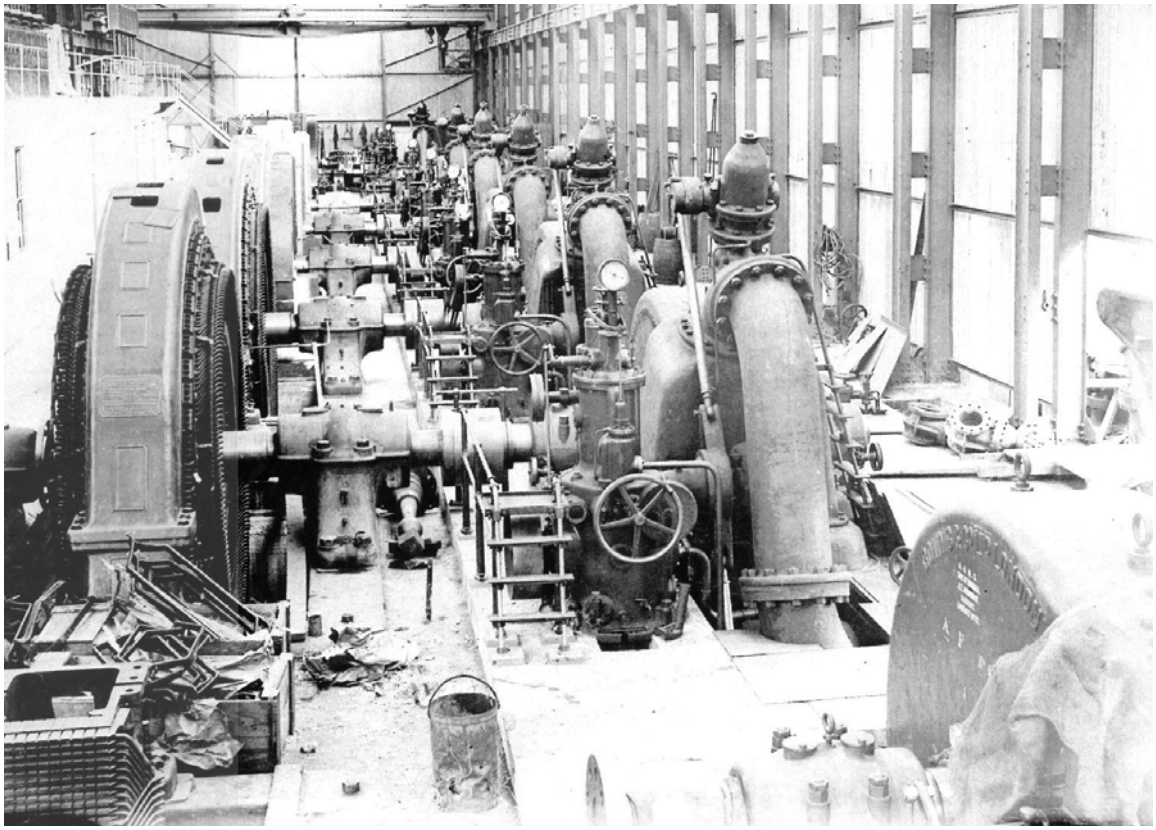


Figure 2.4 Construction of the extension to Waddamana A looking southwest (Hydro Tasmania).

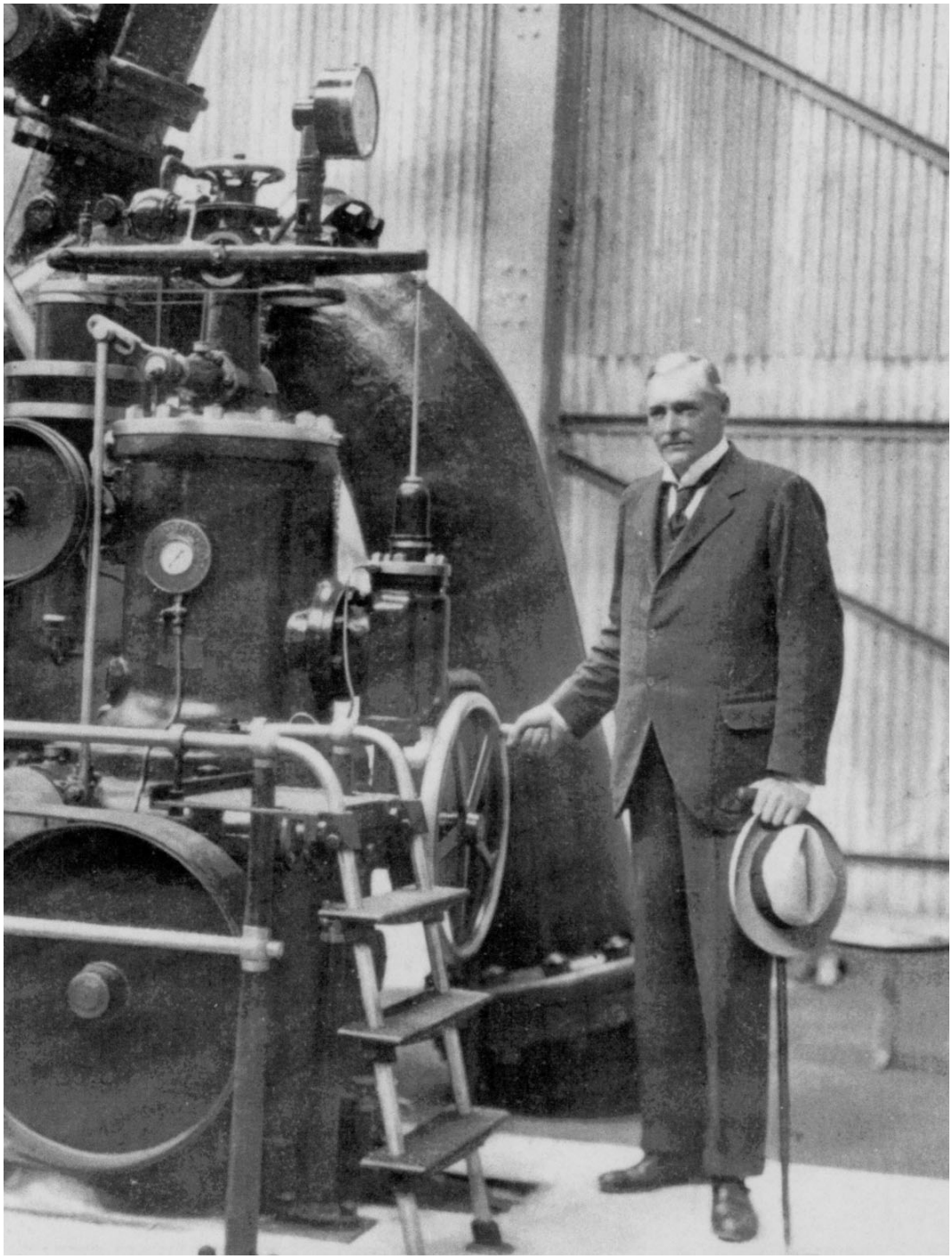


Figure 2.5 Governor General of Australia Lord Forster looks somewhat doubtful about starting the last turbine January 1923 (Hydro Tasmania).

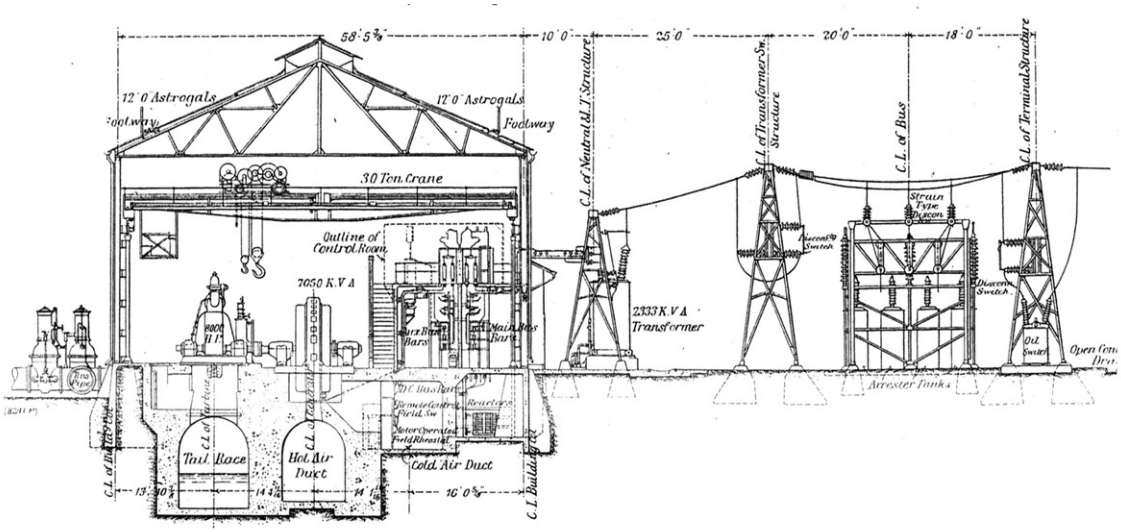


Figure 2.6 Section of Waddamana A (c1924) (Engineering based on an official plan).

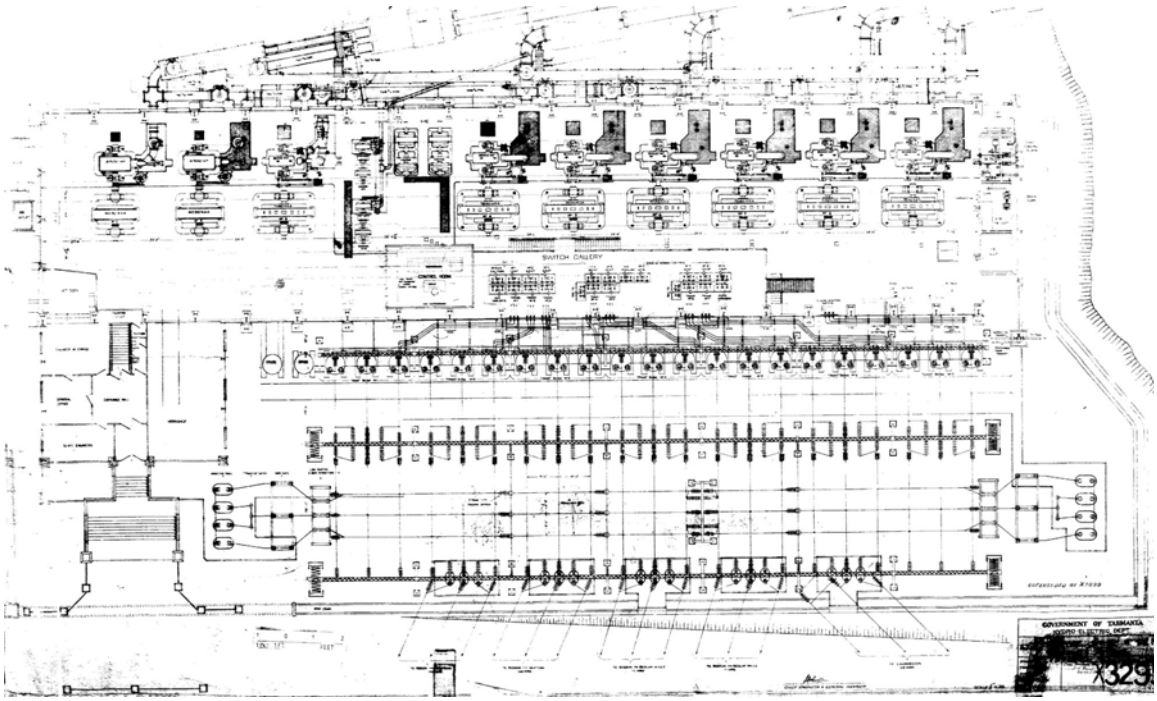


Figure 2.7 Plan of Waddamana A (c1924) (Hydro Tasmania).

Figure 2.8 Aerial photograph of Waddamana A, 1931 (Hydro Tasmania).

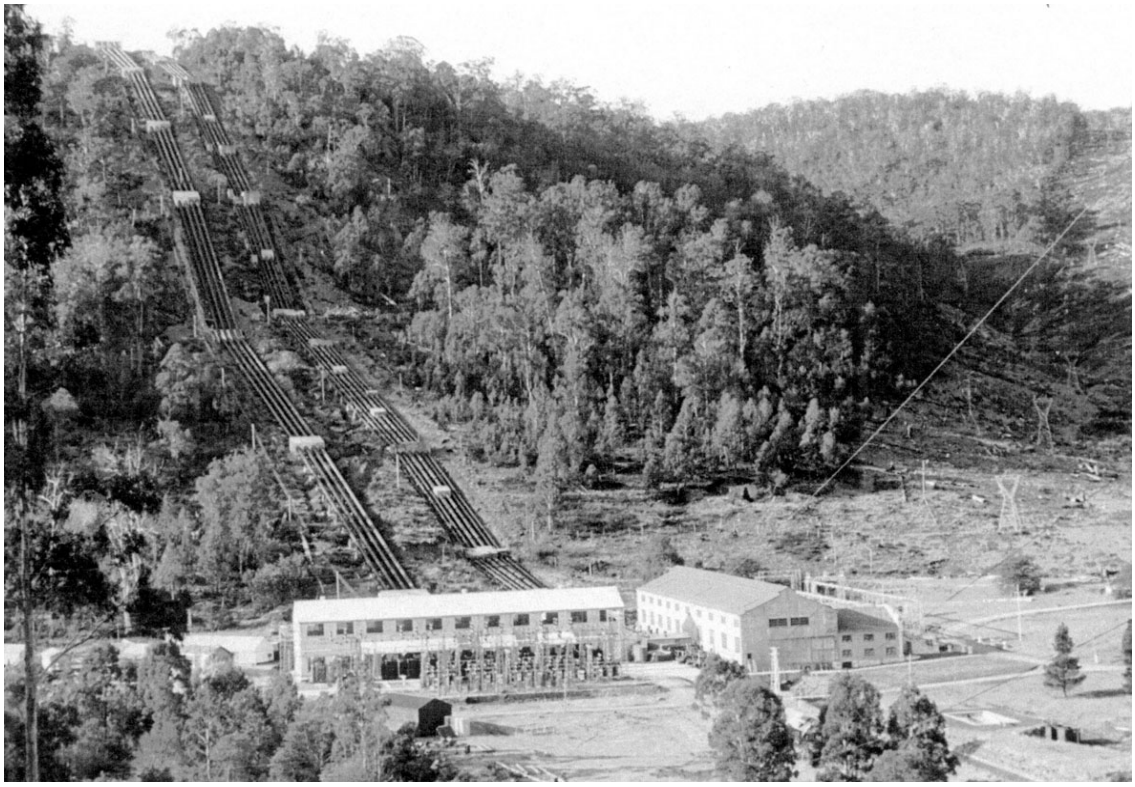


Figure 2.9 Waddamana A and Waddamana B, 1944 (Hydro Tasmania).

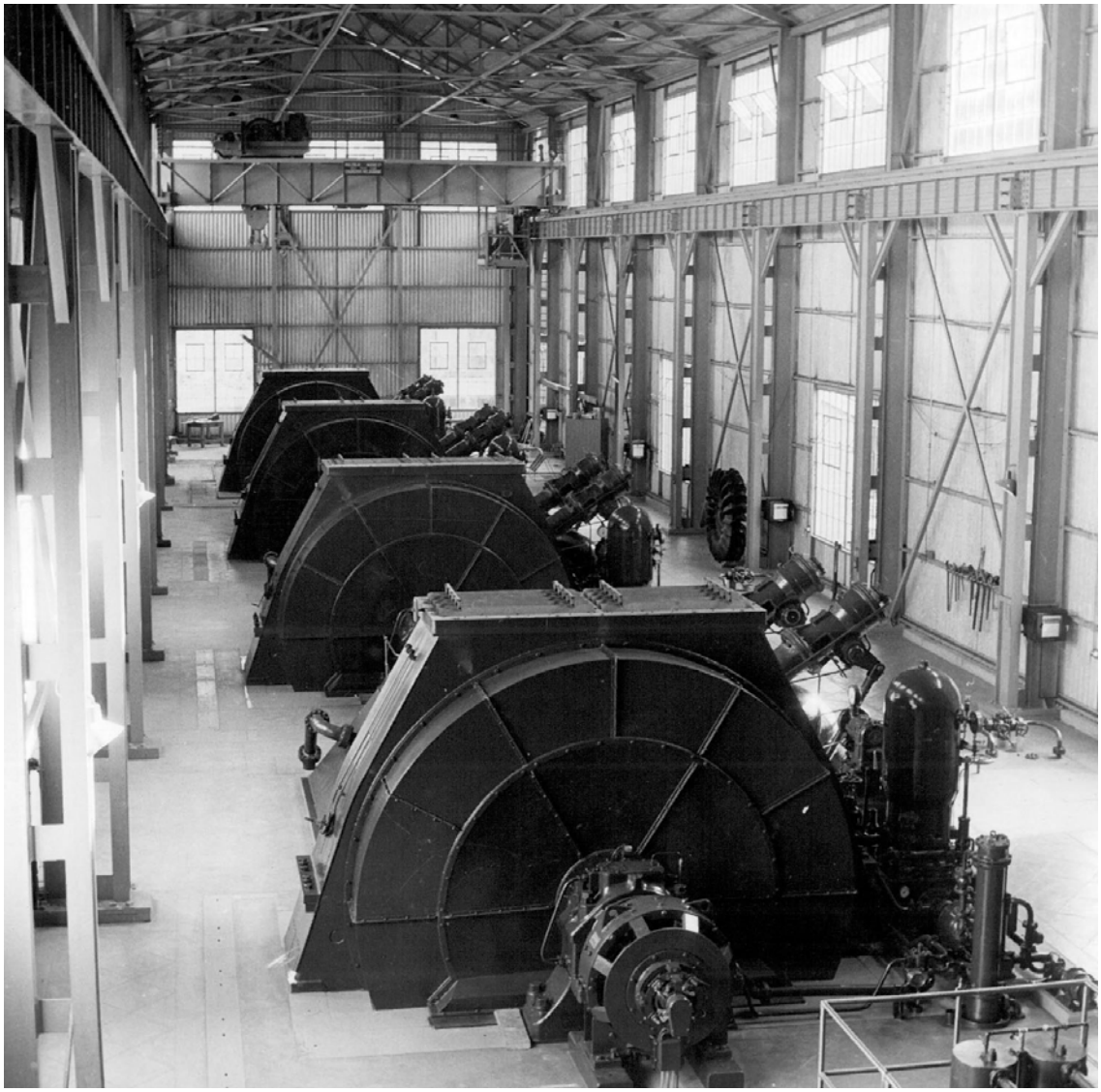


Figure 2.10 Turbines installed at Waddamana B 1949 (Hydro Tasmania).

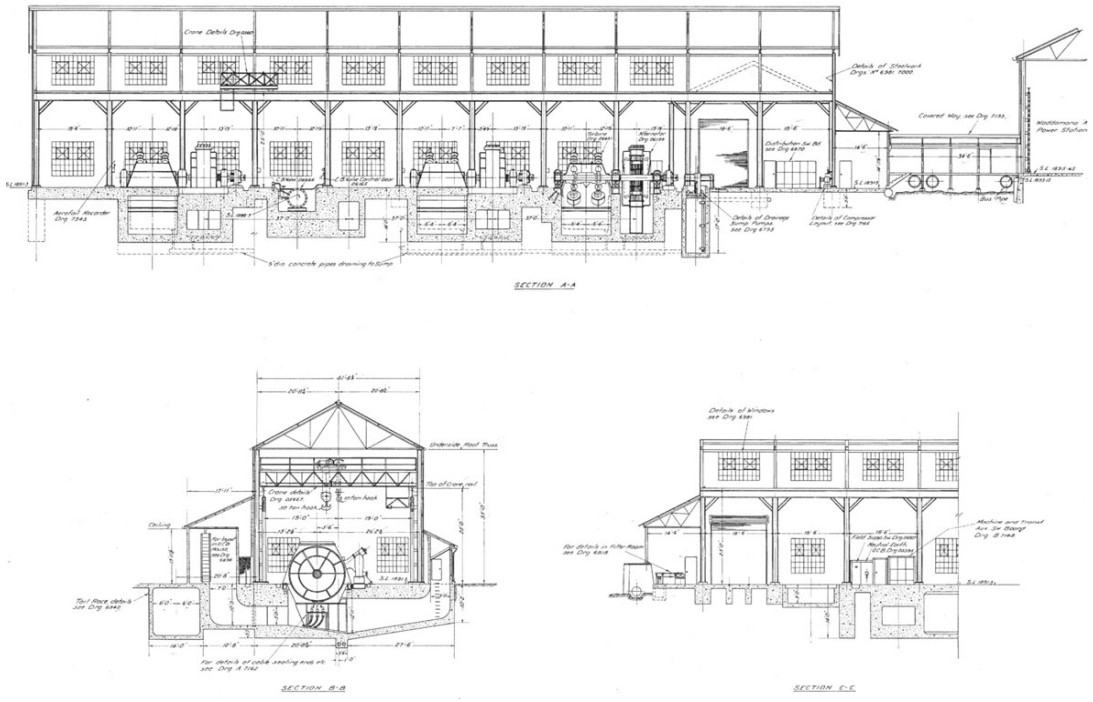


Figure 2.11 Section of Waddamana B ((Hydro Tasmania).

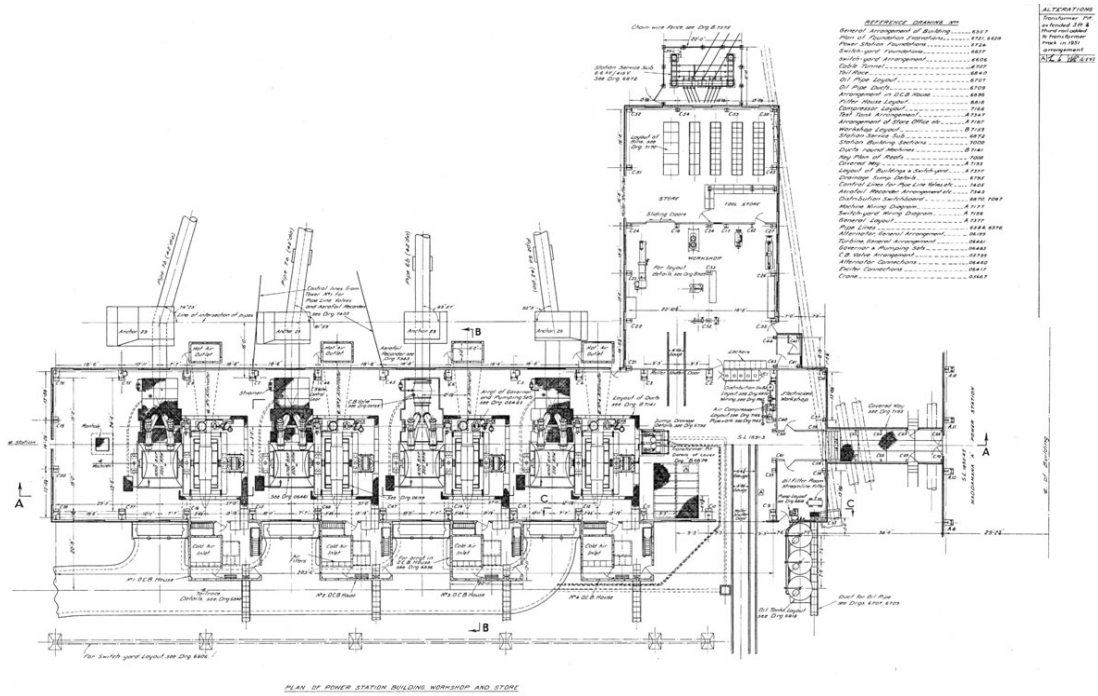


Figure 2.12 Plan of Waddamana B. (Hydro Tasmania A7509).

3.0 Physical Description

3.1 Introduction and Methodology

This section briefly describes the physical elements within the Waddamana study area. More comprehensive descriptions are found in the records in Appendix A (Site Record Sheets) and Appendix B (Movable Heritage Audit).

The Waddamana study area was inspected by Dr Iain Stuart from JCIS Consultants over the period 2–4 May 2006. Some areas were inaccessible as they were either blocked off, contained live electrical equipment or were unlit. The Movable Cultural Heritage recording was undertaken during this inspection.

3.2 Setting

The Waddamana study area is located on the eastern bank of the Ouse River. The river is located on the western edge of its valley leaving a moderately sloped area on the eastern bank. A small stream runs into the Ouse River from the northeast. This stream is located in a comparatively wide valley. This creates a Y-shaped valley (looking north), with the Waddamana study area at the middle of the Y (Figure 3.1).

The penstocks from Penstock Lagoon follow the crest of a ridge to a point (known as Hilltop) where the penstocks make a steep descent to the Ouse River (a drop of some 200m), giving the Power Stations a head of 1,125ft. The Power Stations are located at the toe of this steep descent to take maximum advantage of the fall (Figure 3.2).

Waddamana village (now the field study centre) is located about 100m to the southeast of the Power Stations (downstream from the Ouse River) where the valley floor is flattest (Figure 3.3).

3.3 Processes in the Study Area

In order to understand the remains on the site, it is useful to explain how the Power Station worked. The water was provided in steel pipes called penstocks which ran down the steep slope from the valve house (also referred to as Hilltop). These pipes narrowed slightly as they descended to build up the pressure in the pipes.

At Waddamana A, the penstocks were controlled by inlet valves which led to a common pipe that ran along the length of the building or directly to each Pelton wheel (Figure 3.4). The common pipe was referred to as a 'bus pipe', which is unusual as usually the term 'bus' refers to an electrical connection. In Waddamana B, the penstocks ran directly to each Pelton wheel (Figure 3.5).

Waddamana A had two types of Pelton wheel. The first Pelton wheels installed were single jet, horizontal shaft wheels (Figure 3.6) (the term 'jet' refers to the jet of water which comes out at high pressure to hit the Pelton wheel). The force of the jet was controlled by a 'spear' which could be

moved inside the nozzle of the jet to create greater or lesser pressure. The Pelton wheel turned a shaft which drives the alternator.

The second type of Pelton wheel simply had an upper and a lower jet which was a more efficient method of working (Figure 3.7). This type of wheel was installed in the early 1920s upgrade of Waddamana A.

Waddamana B had a four jet Pelton wheel (Figure 3.8).

The water used in the Pelton wheels was then allowed to discharge into the tail race which ran under the turbines and then outside the buildings into the Ouse River.

The alternator comprised two parts: the rotor and the stator. The rotor was connected to the turbine shaft and consisted of a large number of electromagnets partially embedded in a cylinder of iron. The stator was a large circular ring of iron with heavy bars of copper embedded on its inner surface (Figure 3.9). The rotation of the rotor in the stator generates the electricity which was collected off the generators and went to the main bus.

As the rotor used electromagnets, the power for them had to come from somewhere when the plant was starting up. The exciters were small electrical generators which, at Waddamana A, were powered by two small Pelton wheels (Figure 3.10). At Waddamana B, the exciters were located on the shaft from the turbine (Figure 3.11) and presumably were organised so that as the shaft began to turn, they generated power to the electromagnets in the rotor.

The generators got quite hot during their work and were supplied with cool air via the cool air duct, while the hot air was forced into the hot air duct. The generators had small fins on them that drew the air in and sent it out (Figure 3.12).

The generated power ran into the main bus bars which was located under the switch gallery at Waddamana A, and then through the banks of circuit breakers (Figure 3.13). The circuit breakers allowed the power to be switched to different banks of transformers, as well as drawing power off for auxiliary use.

The current generated by the generators was 6600 volts. It was supplied to the transformers (Figure 3.14) that stepped the current up to 88,000 volts, which is the pressure that it is transported at. The function of the switchyard was to firstly step the power up and then switch it into the appropriate transmission line.

Overall, the whole plant—Waddamana A and B—was able to be controlled from the control room in Waddamana B.

Both Waddamana A and B were equipped with ancillary rooms for workshops, stores, tools and oil filtering. These were all part of the requirement for a site like Waddamana to be relatively self-sufficient.

The most extraordinary element of Waddamana is the extension at Waddamana A for the offices constructed in 1922. The interior of the offices in this building is panelled in Tasmanian blackwood

timber. The timber stairs and lookout over the Turbine Hall are particularly elaborate (Figure 3.15). The entrance to the building is constructed of pseudo-classical columns formed from concrete with a large concrete pediment (Figure 3.16). The architectural effect of this is marred somewhat by the galvanised iron cladding between the columns. Access to Waddamana A is therefore up a set of elaborate stairs through the classical entrance into the timber panelled offices of the engineers from which most of the Turbine Hall could be supervised.

3.4 Precincts

The Waddamana Power Stations are a complex set of items; in order to describe, assess and develop management policies, the place is divided into the following precincts:

Precinct 1: Upper Penstocks	Upper Penstocks above the fence boundary of the Power Stations.
Precinct 2: Waddamana A	Waddamana A Power Station, including penstocks, inlet valves, tailrace and former switchyard.
Precinct 3: Waddamana B	Waddamana B Power Station, including penstocks, tailrace, bridge into Waddamana A, switchyard.
Precinct 4: Outside Workshop	Area to the northwest of the boundary fence adjacent to Waddamana B and west to the Ouse River bank.
Precinct 5: Transmission Lines	Area to the southeast of Waddamana A containing remains of transmission line structures but not current transmission line towers.
Precinct 6: Bush	Area to the southeast of the cleared transmission line easement and north of the road to Shannon.

3.4.1 Precinct 1: Upper Penstocks

The precinct extends from the northern boundary of the land owned by Hydro Tasmania to the south at the boundary fence of the Power Stations. This precinct contains the remains of two penstock lines to Waddamana A and Waddamana B, of which the penstocks to Waddamana A are now mostly removed. The penstocks have been recorded as two separate items. Item 1 is the penstocks to Waddamana A, which consist of a series of steel pipes of varying diameter running down the hill slope. The pipes have been partly removed. Item 2 is the penstocks to Waddamana B, which consist of four steel pipes, which are intact. Visually, the penstocks are quite prominent on the hill slope, partly as their easement is cleared and partly due to the silver colour of the penstocks to Waddamana B.

Ref No.	Name	Condition
1	Penstocks to Waddamana A	Altered sympathetically
2	Penstocks to Waddamana B	Good

This precinct contains two items which are considered to be in generally good condition.

3.4.2 Precinct 2: Waddamana A

This precinct covers items associated with the construction and operation of Waddamana A Power Station.

Waddamana A consisted of the main turbine hall (which runs on a northeast–southwest axis) and an annex running at right angles. The turbine hall was constructed in two stages: the first in 1916 and then extended in the early 1920s to its current length. Evidence of this change is impossible to see in the main hall but in the cold air duct underneath, there is a narrowing in diameter that demonstrates the change between the two structures.

The turbine hall was a steel-framed building clad and roofed with corrugated galvanised iron. Originally, there were skylights in the roof but sometime before World War II, these were clad over and windows installed along the walls. The floor of the turbine hall was concrete ruled and painted to imitate a tiled surface and the walls were partly clad in masonite. The control room was enclosed by a polished wood wall with glass panels allowing the operators a view of the hall.

The turbine hall contained the nine sets of Pelton wheels and generators, the exciters for the generators, the switches and spaces for the main and auxiliary bus bars, and the control room (which controlled both Waddamana A and B). An electric travelling overhead crane was installed to run along the length of the turbine hall. The crane allowed easy disassembly of the machinery and maintenance of the transformers.

Under the hall were three spaces running along the long axis of the building, including the tailrace from the Pelton wheels, the hot air duct and the cold air duct (which also contained electrical equipment and the oil filtering area).

The annex was constructed in the area previously occupied by the interior switch yard of the Power Station in 1916. This was replaced by the annex which was a steel-framed building clad in corrugated galvanised iron. The entrance to the annex and the main building was up an elaborate flight of stairs. The entrance façade of the annex is decorated in a concrete pseudo classic form (with galvanised iron infill). The upper story of the annex, to which the main entrance steps led, was a series of timber-panelled offices and a set of stairs leading to the turbine hall floor. Over the stairs was the engineer's lookout which was a timber panelled lookout with glass panels. The lookout was supported by decorative timber columns.

The lower story of the annex was the workshop area. This included a small tramway running out to the switch yard which allowed transformers to be moved into the workshop for maintenance and repair. A turntable was located in the floor of the workshop which allowed the transformers to be moved on a tramway into the Turbine Hall. Adjacent to the workshop was the store room and the sling store.

Outside the building, along the southeast side of the building, was the switch yard. This contained the remains of the switching equipments and transformers, and a small display of movable cultural heritage related to the museum.

Waddamana A has been refitted as a museum, and the exhibits are located around the interior walls of the building and in the switch gallery. The items on display are discussed in the section of movable cultural heritage. As part of the adaptation of the building to its museum function, a disabled toilet and a display gallery were installed.

Ref No.	Name	Condition
3	Penstock and inlet valves	Altered sympathetically
4	Turbine hall	Good
5	Turbine hall—Overhead Crane	Good
6	Turbine hall—Turbine 1	Good
7	Turbine hall—Turbine 2	Good
8	Turbine hall—Turbine 3	Good
9	Turbine hall—Turbine 4	Good
10	Turbine hall—Turbine 5	Good
11	Turbine hall—Turbine 6	Good
12	Turbine hall—Turbine 7	Good
13	Turbine hall—Turbine 8	Good
14	Turbine hall—Turbine 9	Good
15	Turbine hall—Exciter 1	Good
16	Turbine hall—Exciter 2	Good
17	Turbine hall—Exciter 3	Good
18	Turbine hall—Exciter 4	Good
19	Switch gallery	Altered sympathetically
20	Control room	Altered sympathetically
21	Bus bar area	Altered unsympathetically
22	Relay room	Altered unsympathetically
23	Controls	Good
24	Battery room	Good
25	Disabled toilet	Good
26	Tail race under turbines	Not known
27	Hot air duct	Not known
28	Cold air duct	Good

Ref No.	Name	Condition
29	Oil tanks and pumps	Good
30	Workshop	Good
31	Engineers in Charge Office	Good
32	General office	Good
33	Shift Engineers' Office	Good
34	Entrance hall	Good
35	Engineers' lookout and drawing office	Good
36	Toilets	Good
37	Stairs	Good
38	Store room	Good
39	Sling room	Good
40	Switch yard	Good
41	Annex	Not known
52	Tailrace	Good
62	Entrance to Waddamana A	Good

Precinct 2 contains a large number of items in good condition. Overall, the whole Power Station is in good condition with little evidence of alteration since its finalisation in 1922.

3.4.3 Precinct 3: Waddamana B

This precinct covers items associated with the construction and operation of the Waddamana B Power Station.

Waddamana B Power Station consisted of the turbine hall which was steel-framed and clad, and roofed with corrugated asbestos cement sheeting. The historical records show that the material used was Hardies' 'Fibrolite', a common cladding material at the time.[1]

The turbine hall contained the four sets of Pelton wheels, generators and exciters. The turbines were organised differently than those in Waddamana A, with the water and air entering through the short axis of the building rather than along the long axis. This has left the building with under-floor ducts for water and air (cool air coming in and hot air being exhausted). Electrical switching and buses are located adjacent to each turbine.

[1] Galvanised iron was a 'strategic material' during World War II, whereas asbestos cement wasn't, so it was commonly used in place of galvanised iron.

Turbines 2 and 3 had a commemorative plaque stating 'This tablet commemorates the building of this unit by the workers of Great Britain and its transportation to Tasmania by British seaman during the war years, 1939–1944.'

The turbines are partially disassembled, suggesting that they were being used for spares for similar sets at Tarraleah. Turbine 4 seems the most complete of the set. There are also various items around the walls of the building, some of which may be spares and some museum exhibits—it is difficult to tell.

An electric, travelling overhead crane runs the length of the turbine hall. There is an air compressor mounted at the southeast end of the building.

A steel-framed asbestos-clad annex is located at the southeastern end of the building. This contained the workshop, store room and the tool store. The store room is still in use and the workshop is probably being used as well. The tool room is substantially intact and consists of shadow boards and tools, and is a classic example of its type.

A lean-to annex with a skillion roof is at the southeast end of the building. This provides two rooms, one of which was used as an electricians' workshop (now a crib room), and the other for filtering oil. Between these rooms is the covered way over the penstocks to Waddamana A.

The switchyard for Waddamana B has been removed, leaving only concrete foundations.

Ref No.	Name	Condition
42	Penstocks to Waddamana B	Good
43	Turbine hall	Good
44	Turbine hall—Turbine 1	Poor
45	Turbine hall—Turbine 2	Fair
46	Turbine hall—Turbine 3	Fair
47	Turbine hall—Turbine 4	Good
48	Pumps	Good
49	Overhead crane	Good
50	Hot air outlet	Good
51	Cold air inlet	Good
53	Tailrace under Waddamana B	Not known
54	Oil filter room	Good
55	Electricians' Workshop	Good
56	Covered way to Waddamana B	Good
57	Workshop	Good

Ref No.	Name	Condition
58	Tool store	Good
59	Store	Not known
60	Waddamana B switch yard	Poor
61	Tailrace	Good
68	Room over workshops	Good

Precinct 3 contains a large number of items in good condition, although not as good a condition as Waddamana A.

3.4.4 Precinct 4: Outside Workshop

Ref No.	Name	Condition
63	Workshop area	Good (as ruins)

Precinct 4 contains the archaeological remains of the buildings shown on the 1949 plan.

3.4.5 Precinct 5: Transmission Lines

Ref No.	Name	Condition
64	Transmission lines	Good (as ruins)
65	Row of pine trees	Good
67	Electrolytic lightning arrestor	Good
70	Electric light poles	Good

Precinct 5 mainly contains vegetation and footings for the transmission towers.

3.4.6 Precinct 6: Bush

Ref No.	Name	Condition
66	Quarry site	Not known

Precinct 6 contains the remains of a quarry which may or may not be associated with the Power Station; it is of little interest in relation to the Power Stations.

3.5 Movable Cultural Heritage Items

During the field work, a summary audit was made of the movable heritage. As stated in the project brief, this excluded the spare parts store, the sling room and storage room, the mess room, the office

and engineers' office in Waddamana A, and the storeman's room off the machine store (the tool room) in Waddamana B. All photographic displays were excluded.

In order to attempt a significance assessment, the movable heritage collections were related to the three apparent themes of the museum. These were defined as being:

- Waddamana Power Stations;
- the Great Lakes Scheme; and
- the history of hydro-electricity in Tasmania.

A total of 76 records were made. Ten records related to movable heritage items or displays that directly related to the Waddamana Power Stations, 15 to the broader Great Lakes Scheme, and the remaining 61 records related to items of displays that were broadly to do with the history of hydro-electricity in Tasmania. Most of the items were to do with the processes of running the power system but some of the movable heritage, particularly those in the switch gallery, related to the domestic use of electricity. It should be noted that the Hydro-Electric Commission used to sell domestic appliances as part of a program to promote electricity consumption.[2]

Most of the movable heritage items are complete; however, they are often decontextualised as they have been removed from their original locations.

3.6 Conclusion

To conclude, it is apparent that both Waddamana A and Waddamana B are substantially intact examples of hydro-electric power stations in generally good condition. They retain a high degree of integrity. Together, they are excellent examples of hydro-electric generating technology from 1910 to the 1950s.

[2] Sarah Waight pers. com.

Figure 3.1
Waddamana A and B looking northeast.

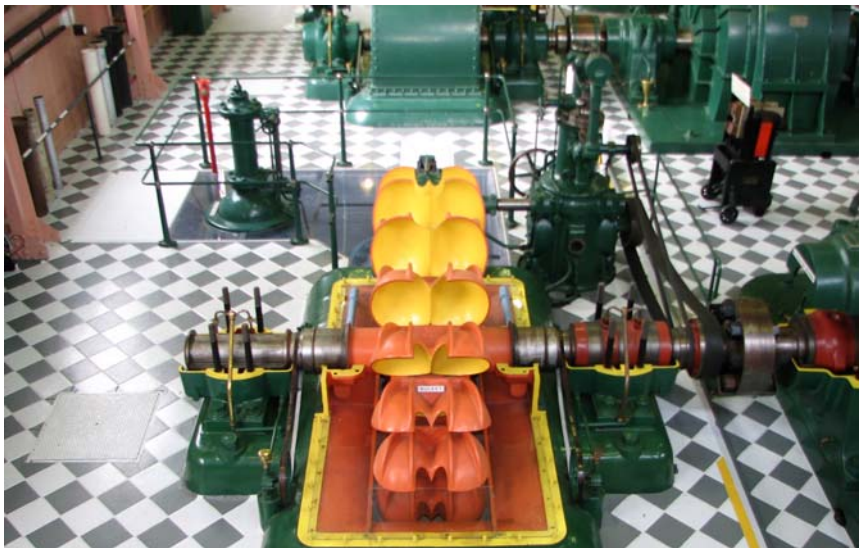
Figure 3.2
Penstocks coming down the hill to the power stations.

Figure 3.3
Waddamana Village (now the Field Studies Centre).

Figure 3.4
Inlet pipes Waddamana A.

Figure 3.5
Penstocks entering Waddamana B.

Figure 3.6
Pelton Wheel, Turbine 1 Waddamana A.



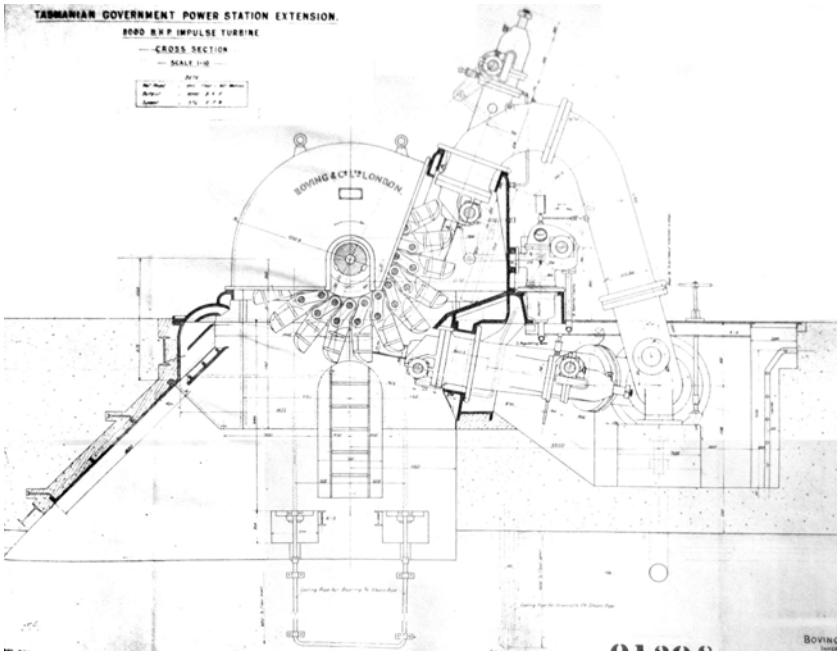


Figure 3.7
Plan of two jet Turbine.

Figure 3.8
Pelton wheel, Turbine 1 Waddamana B.

Figure 3.9
Generator, Turbine 1, Waddamana A.

Figure 3.10
Pelton wheel exciter No 1, Waddamana A.

Figure 3.11
Exciter on the turbine shaft, Turbine 4 Waddamana B.

Figure 3.12
Cold air duct, Waddamana A (looking southwest).

Figure 3.13
Circuit Breakers, Switch Gallery Waddamana A.

Figure 3.14
Transformer, switchyard Waddamana A.

Figure 3.15
Stairs and engineers lookout Waddamana A.

Figure 3.16
Entry to Waddamana A (looking northwest).

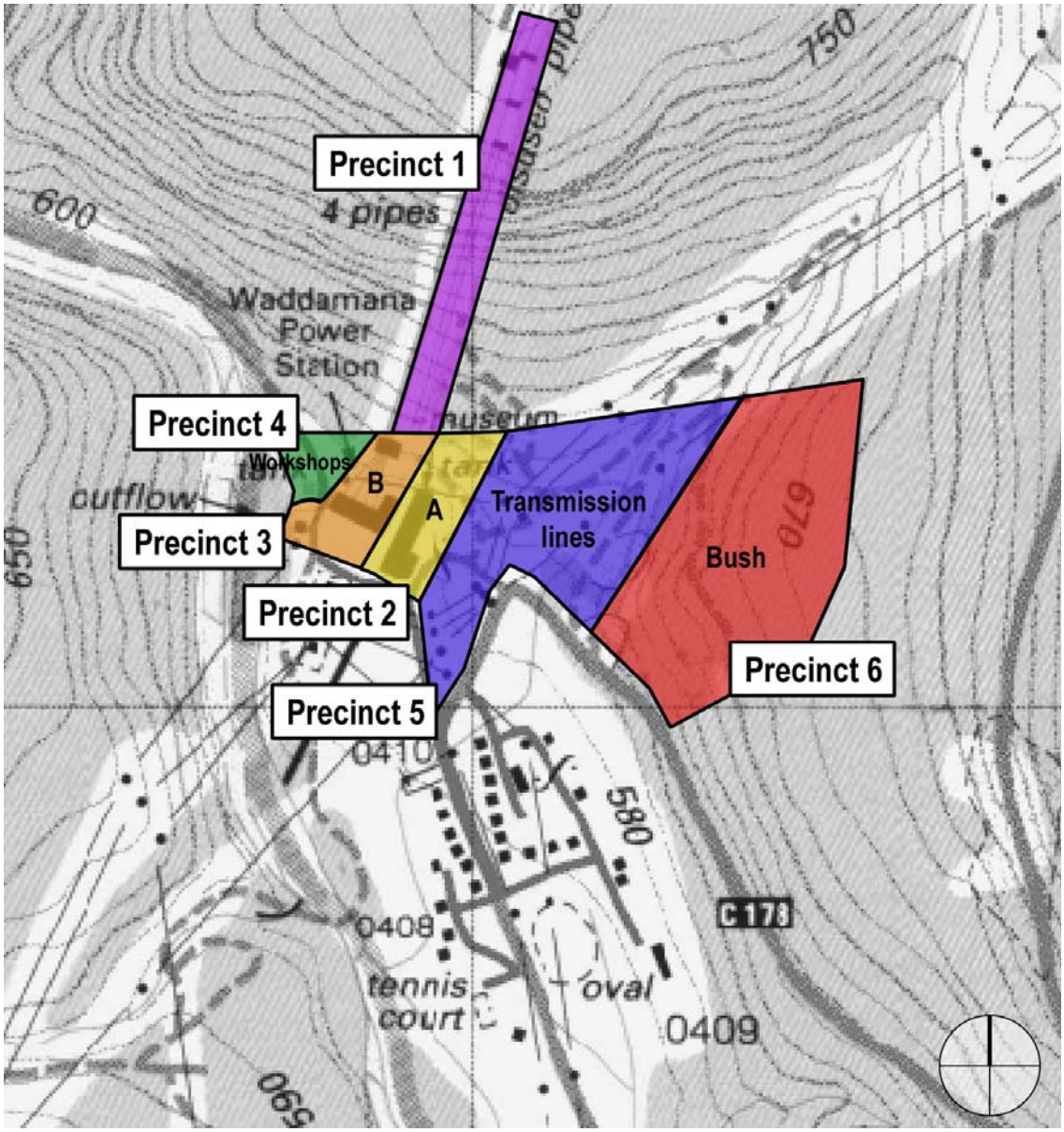


Figure 3.17 Waddamana Power Station precincts.

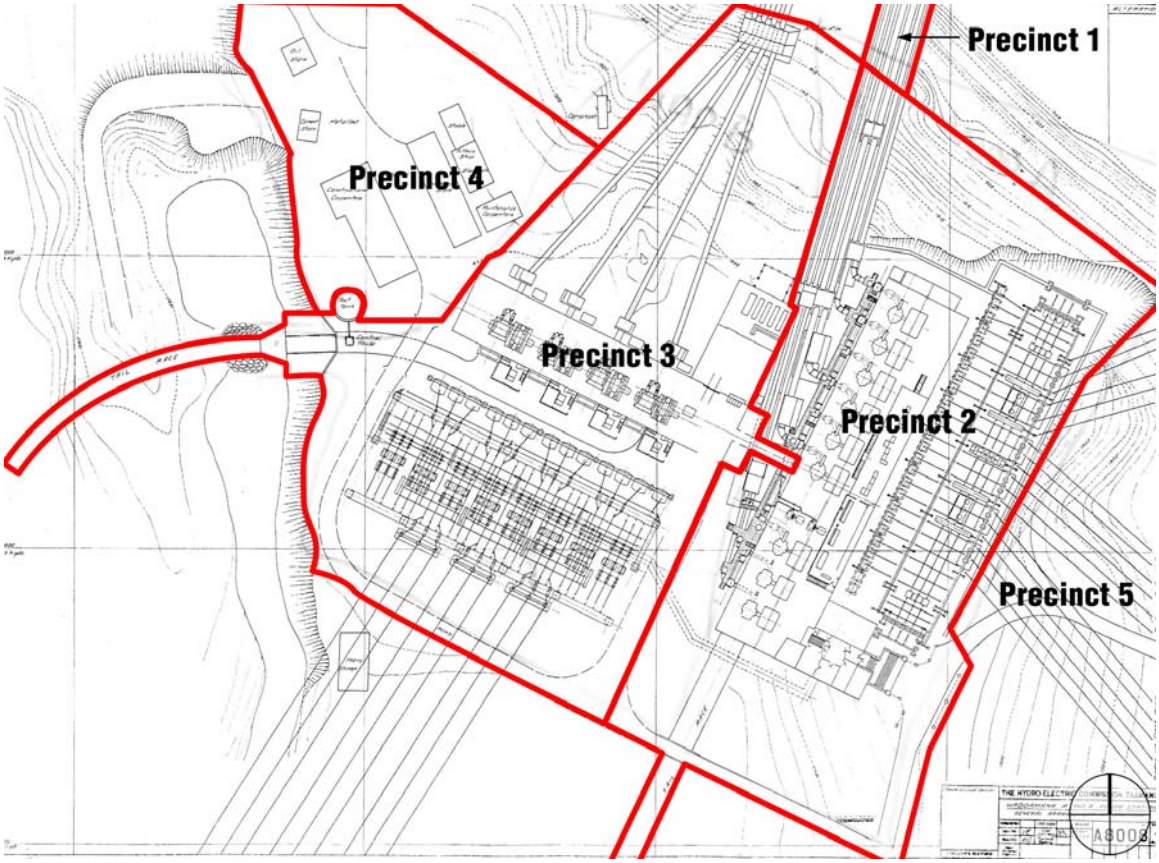


Figure 3.18 Plan of Wadamanna precincts.

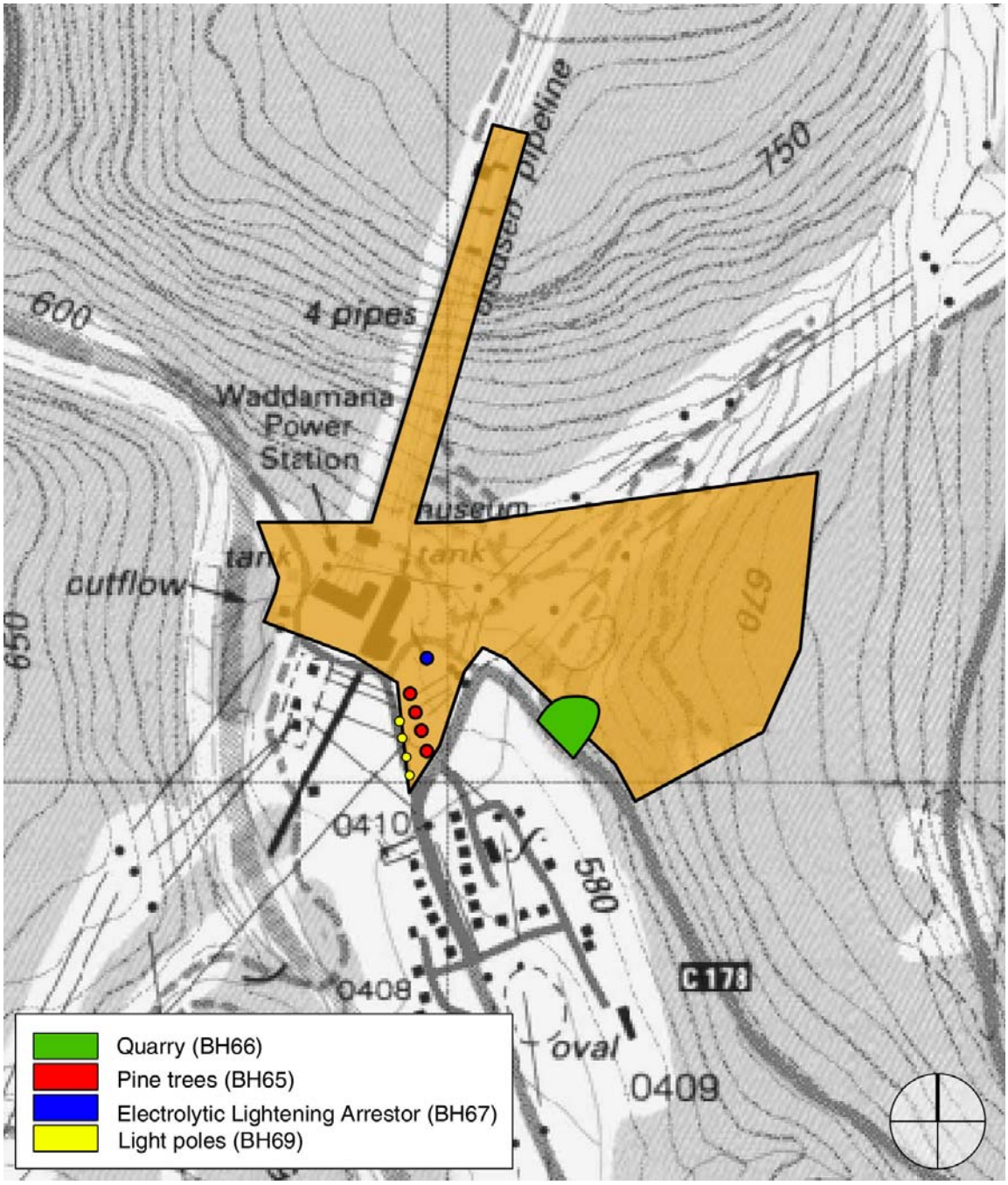


Figure 3.19 Location of heritage items in Precincts 5 and 6.

4.0 Comparative Analysis

Comparative analysis is undertaken to provide a framework for assessing the cultural significance of a place. Comparative analysis considers the history and physical evidence of a particular site within relevant historical contexts in order to understand how typical or unique the history of a particular site may be. In the context of the history of the Waddamana study area, there are two general themes:

- development of hydro-electric technology; and
- development of Tasmania's hydro-electric power (which is in effect the history of the Hydro-Electric Commission).

4.1 Development of Hydro-Electric Technology

The production of hydro-electricity represents the combination of one very old technology—the use of water to drive a wheel and thus a power shaft—and that of electrical generation. The latter dates from Faraday's demonstration of a primitive dynamo in 1831.[1] The water wheel dates from at least the time of the Egyptian Pharaohs and the Ancient Chinese.[2] During the eighteenth and nineteenth centuries, the water wheel underwent a considerable amount of development which significantly changed the power output from the water wheel (or turbine as they are also known). Three turbine designs are typically used in hydro-electric plants: Francis, Kaplan and Pelton.[3] Pelton is the type used for the greatest head of water.

Lester Pelton developed the Pelton wheel in 1880 using a jet of water into a split bucket. Initially they used a single jet and a horizontal shaft, then two jets. A four jet version, such as that used at Waddamana B and Tarraleah, is considered rare.[4] Larger Pelton wheels are organised around a vertical shaft which allows more jets and a more efficient arrangement of generators. An example of this type of Pelton wheel is the equipment at Poatina (1964), which was the next station to be equipped with Pelton wheels after Waddamana B in 1949.[5]

The dynamo was a cheap and efficient means of generating electricity; all that one had to do was power the dynamo and develop uses for electricity. Improvements were made to the dynamo, as well as the development of electrical motors and arc and incandescing lamps which generated a demand for electricity. By the 1880s, generating plants coupling the dynamo with a steam engine were being introduced for industrial and domestic use.[6]

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[1] 'Dynamo' LoveToKnow 1911 Online Encyclopaedia, http://69.1911encylopedia.org/D/DY/Dynamo/html

[2] Kjolle, A 2001, 'Hydropower in Norway, Mechanical Equipment: A survey', http://www.tev.ntnu.no/vk/publikasjoner/, p 1.3.

[3] Kjolle, op cit, p 1.4; Scanlon, A 2003, The power of Nature, Hobart: Hydro Tasmania.

[4] Kjolle, op cit, p 6.1.

[5] Ironically forcing the closure of Waddamana A.

[6] 'Electricity Supply.' LoveToKnow 1911 Online Encyclopaedia, http://69.1911encylopedia.org/E/EL/Electricity_Supply/html

Early experiments in driving dynamos by water power occurred at Grand Rapids Michigan in 1889 and in 1881 at Niagara Falls. There was, however, the problem of distributing the generated power over long distances. The original dynamos or generators produced direct current (DC) power; this was the system that Thomas Edison, among others, favoured. However, high loads of direct current could rarely be transmitted for distances greater than one mile without introducing excessive voltage drops. The alternative was alternating current. The overwhelming advantage of alternating current (AC) was that it could be transformed to a high voltage, and high voltage/low current distribution would only suffer relatively minor power losses due to line resistance. The development of the transformer, an electrical device that transfers energy from one circuit to another, and used to transform the nature of an electrical current in the early 1880s, allowed the use of AC power to transmit electricity long distances (for the time).[7]

The critical project where this technology was demonstrated was at Niagara Falls. In 1883, the Niagara Falls Power Company hired George Westinghouse to design a hydro-electric system to generate alternating current. Westinghouse had considerable experience with AC and had acquired many key patents to do with its production and transmission. By 1896, Niagara Falls Power Company had constructed giant underground conduits leading to turbines generating upwards of 100,000hp, and were sending power as far as Buffalo, 20 miles (32km) away.[8] However transmission technology was at its limit until 1907 when the invention of the disk insulator allowed the use of higher voltages and greater practical transmission distances.[9]

Early hydro-electric power schemes in Australia, such as that at the Garra River (1883), were limited because of the technological restrictions on transmission distribution, and thus seemingly poor commercial decisions to site plants in areas of limited demand were made.[10] The major difficulty in Australia was that suitable water sources accompanied by a useful fall (to gain enough head to drive the water wheel) were rarely located near a suitable market for electricity. However, this was not necessarily the case for Tasmania.

The Duck Reach Power Development was built and operated by the Launceston City Council in 1895. The plant was located on the South Esk River two miles from Launceston. The plant was a 'run of the river' station, making use of very little storage, and instead using the daily flow of the South Esk River to provide sufficient water for generation. An 850-metre tunnel drilled through the rock supplied water from Deadmans Hollow to an iron pipeline that plunged straight down the hill into the Power Station, with a discharge rate of 5,537 litres per second, entering the eight Siemens turbines inside the station. This plant was the first publicly owned hydro-electric plant in Australia and the first really successful domestic plant.

[7] 'Electricity', 'Transformer', 'War of Currents', Wikipedia, http://en.wikipedia.org
[8] 'George Westinghouse', 'Niagara Falls', Wikipedia, http://en.wikipedia.org
[9] 'Electric Power Transmission', Wikipedia, http://en.wikipedia.org
[10] For details of the Garra scheme, see Gojak, D 1988, Gara River: an early Hydro-Electric scheme in Northern New South Wales, *Australian Historical Archaeology*, 6, pp 3–11.

Smaller plants were established in Tasmania to supply mining operations and often supplied domestic power to nearby residences. Examples of such plants were the Waratah Power Station at Mount Bischoff (1907) or Moorina (1909). Lake Margaret Power Station (1914) was a relatively low-powered plant with a low voltage transmission line over a small distance to Mount Lyell. It was the last plant of this nature in Tasmania.[11]

Waddamana A, while initially a small plant certainly, transmitted power at a high voltage and over a long distance, 65 miles to Hobart. It is clear from Butters' comments that the plant was designed to be easily expanded if demand required[12] and by 1922, Waddamana was operating on a large scale, making it the largest hydro-electric plant in Australia.

The turbines used at Waddamana are best described as being Pelton type as they were Pelton wheels but not manufactured by Pelton's, who were the original patentees. They were manufactured by Bovings, who supplied most of the electrical plant to Waddamana and to the first stage of Tarraleah.[13] The Pelton wheel was considered to be the most appropriate water wheel technology given the respective water heads, whereas the Francis wheel was used at Shannon. However for some reason, Boving was blamed for the delays in commissioning Shannon and subsequent failures of the plant.[14] This allowed English Electric to become a favoured supplier and to supply a more powerful plant—the four jet Pelton wheel.

How typical or rare is the four jet Pelton wheel? This is difficult to find out from standard reference works partly because the larger wheels were vertically mounted and thus jets could be mounted around the whole circumference of the wheel, whereas for horizontally mounted wheels, there was limited room to mount jets effectively. Therefore, although there are references to six jet wheels, these are vertically mounted. The manufacturers literature sent to the Hydro by Bovings does not show any more than a two jet Pelton wheel so it seems likely that the turbines installed at Waddamana B are comparatively rare.

Details of plant and equipment are rarely given in general histories of the development hydro-electric power; however, it seems that the technology used at Waddamana was up to date at the time of instillation but not pioneering in the world context. As befits careful investment, it was a safe purchase. In the Australian context, Waddamana was pioneering in its size and the distance of electricity transmission. Similar plants were installed on the mainland towards the mid to later 1920s; however, this may be a function of the relative ease that a thermal power station could be built on the mainland in comparison with Tasmania's conveniently located hydro power.

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[11] Davies, Paul 2006, 'Lake Margaret Power Scheme: A Conservation Management Plan Volume 1', report to Hydro Tasmania by Paul Davies Pty Ltd, pp 36–37.

[12] Author not stated, 1924, 'The Great Lakes Hydro-Electric Scheme, Tasmania', *Engineering,* March to May, pp 355–57, 451–52, 568–70, 95, 694, 792–93, based in information supplied by Butters.

[13] Hydro-Electric Commission of Tasmania Power Developments, Machine Date, report held in the Library Hydro Tasmania.

[14] Lupton, R 1988, Lifeblood of Tasmania, Hydro-Electric Commission Tasmania, p 113; also Bovings letter 1929 in Waddamana B Project Generally, DX8-14, 1929–1957, AA520/106.

In the 1950s and 1960s, the Francis turbine was more often found in power stations, especially those of the Snowy Mountains scheme which pioneered new ways of using the Francis wheel. This trend was also found in Tasmania. Both Waddamana Power Stations therefore have technology which, although not obsolete, has certainly been replaced by more modern applications of the same principles.

4.2 Development of Tasmania's Hydro-electric Power

From the inception of the Great Lakes Scheme, there was concern that if the project were successful then the Hydro-Electric Power and Metallurgical Company might end up with a monopoly on Tasmania's power generation.[15] However, once the company got into difficulty, the Earle Labor Government purchased its assets and established the Hydro-Electric Department in October 1914. The Hydro-Electric Department was the first state-wide Government-owned power-generating body in Australia.[16]

Butters, while at Hydro-Electric Power and Metallurgical Company, had begun a program of data collection to form the basis for a further expansion of hydro power. This program was extended when Butters moved to the Hydro-Electric Department with a view to examining the whole question of the water power resources of Tasmania.[17] Butters was also keen to use the lure of cheap power to establish an industrial base for Tasmania. The strategy was to look for industries that used large blocks of power which would provide a base load for Waddamana. Thus right from the start, 'Hydro Industrialisation' was a government policy.

What is not really examined in histories is the change in people's lives through the advent of electricity. Provision of electricity enabled the sale of consumer products such as stoves and hot water systems which gradually changed the nature of people's lives. By providing cheap domestic power, the Hydro-Electric Department was facilitating social change.

At the end of the 1920s, the Tasmanian Government formed the Hydro-Electric Commission which officially came into being on 18 January 1930. The Hydro-Electric Commission took over all assets of the Hydro-Electric Department. They also took over something of a crisis in power generating capacity. In 1929 there was a rising demand for power with demand peaking at 61,000hp, not far short of the overall capacity of 65070hp.[18] Most of the power (63%) went to industry and if demand was to be met, then generating capacity needed to expand.[19]

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[15] Robson, L 1991, *A History of Tasmania: Volume II Colony and State from 1856 to the 1980s*, Melbourne, Oxford University Press, pp 295–296.

[16] The next similar body was Victoria's State Electricity Commission in 1918. It was not until the post-World War II period that other states developed similar bodies.

[17] Butters, JH 1926, 'Notes on the Development of the Power Resources of Tasmania', *Transactions of the Institution of Engineers Australia*, Volume 7: 3-36, pp 4–5.

[18] Lupton, op cit, p 104.

[19] Garvie, RMH 1962, *A Million Horses: Tasmania's Power in the Mountains*, Hobart, The Hydro-Electric Commission, Tasmania, p 21.

The Hydro-Electric Department had proposed the Shannon scheme which involved diverting some of the flow of water from the Great Lake through a small power station at Shannon before letting it flow to Waddamana. Although this scheme was approved in 1923 in the post-Butters period, work was sporadic and the scheme was far from completion.[20] Work was urgently pushed ahead and plans for another power station at Waddamana were floated; however, power demand dropped rapidly due to the onset of the Depression which impacted heavily on world demand for zinc, thus forcing the Electrolytic Zinc Company, the Hydro's biggest customer, to cut production.

During the Depression, the political debate about how to boost employment was polarised. AG Ogilvie, the Labor leader, lead his party to victory in the 1934 election by using the need to expand the Hydro-Electric Commission and, in particular, the proposed Tarraleah scheme, as a political weapon. It appears he obtained inside information on the development from within the Hydro-Electric Commission.[21] The Tarraleah scheme was used for unemployment relief and some 1,759 men were employed on construction work. Tarraleah opened in early 1938; in May 1939, Ogilvie announced that Tarraleah would be expanded and in June, that Waddamana B would be constructed marking a further stage in hydro-industrialisation.

After World War II, the Chief Engineer AW Knight was appointed to run the Hydro-Electric Commission. Knight was a dynamic person and led the Hydro-Electric Commission to greater programs of construction. Demand was also increasing at a compound growth of 10% during the 1950s. The Hydro-Electric Commission built on this success by seeking more water resources and more energy intensive industries to use the power.

Owing to rapid population growth and diversifying economics in the mainland states after World War II, the comparative advantage in energy that Tasmania enjoyed was eroded and it became apparent in the mid-1970s, new directions were needed. By the early 1980s, all the cheaper and more accessible hydro-development sites had been exploited, industrial growth was faltering and the Hydro-Electric Commission was coming under intense pressure from environmentalists, annoyed at destruction of wilderness and querying the value of further hydro development in Tasmania. During this time, the Hydro-Electric Commission became directly involved in Tasmanian politics in a way that would have surprised Butters.

Seen in a national perspective, this link between power development and economic growth is not unusual, especially in the post war period. In fact, Tasmania had a competitive advantage over New South Wales at that time, in that it had a reliable power industry, not one fragmented, short of capacity and subject to numerous strikes. Strong leadership by engineers was also not unusual; for example, Sir John Monash was head of the State Electricity Commission in Victoria, while Sir William Hudson Head was the of the Snowy Mountains Authority. Both were strong men leading semi-autonomous government authorities.

[20] Lupton, op cit.
[21] Robson, op cit, p 429.

4.3 Summary

In a technological context, Waddamana A was not a revolutionary plant, but in terms of the application of hydro-electric technology in Australia, it was the pioneering plant and the seed of the later hydro-electric development in Tasmania. Waddamana B and Tarraleah both introduced the four jet Pelton wheel which is a rare development of the Pelton wheel.

In the context of theme development of Tasmania's hydro-electric power and history of the Hydro-Electric Commission, Waddamana A is of great importance as the first of many plants that came after and for its associations with the early period of the Hydro. Interestingly, Waddamana B was the product of the second more intense phase of hydro-industrialisation where construction of hydro projects served a dual role: unemployment relief and infrastructure development. These were the years where hydro development was generally seen as 'nation or state building' but where the close interconnection between the Government and the Hydro had not yet developed.

5.0 Significance Assessment

5.1 Principles

The concept of 'cultural significance' or 'heritage value' embraces the value of a place or item, which cannot be expressed solely in financial terms. Assessment of cultural significance endeavours to establish why a place or item is considered important and is valued by the community. Cultural significance is embodied in the fabric of the place (including its setting and relationship to other items), the records associated with the place, and the response that the place evokes in the community.

5.2 Tasmanian Heritage Assessment Criteria

The Tasmanian *Historic Cultural Heritage Act 1995* defines historic cultural heritage significance as follows:

> *historic cultural heritage significance in relation to a place, means significance to any group or community in relation to the archaeological, architectural, cultural, historical, scientific, social or technical value of the place.*

The criteria for assessing whether a place is of historic cultural significance or not is set out in Section 16 of the Act as being:

> *a) it is important in demonstrating the evolution or pattern of Tasmania's history;*
>
> *b) it demonstrates rare, uncommon or endangered aspects of Tasmania's heritage;*
>
> *c) it has potential to yield information that will contribute to an understanding of Tasmania's history;*
>
> *d) is important as a representative in demonstrating the characteristics of a broader class of cultural places;*
>
> *e) it is important in demonstrating a high degree of creative or technical achievement;*
>
> *f) it has strong or special meaning for any group or community because of social, cultural or spiritual associations;*
>
> *g) it has a special association with the life or work of a person, a group or an organisation that was important in Tasmania's history.*

These criteria have been used to assess the historical cultural heritage significance of the Waddamana study area.

5.2.1 Significance Assessment Grading

Within the Waddamana study area, future consideration of use and management options for the area may involve removal of, alteration to or impact on specific elements within the area. The individual precincts, buildings and items within the area have been assessed by adopting the five-class system used by Davies in his previous assessments of Hydro Tasmania's heritage.[1] The ranking introduces a grading that assists in quantifying the degree to which buildings, structures, items of machinery and equipment etc contribute to the heritage value of the site overall. The five rankings are defined in Table 5.1 below.

Table 5.1 Significance Ranking

Ranking	Significance
5	Very high
4	High
3	Medium
2	Low
1	Neutral
0	Intrusive

5.3 Significance Assessment

Criterion A: Important in demonstrating the evolution or pattern of Tasmania's history.

The Waddamana study area and the whole Great Lakes Scheme are important in demonstrating a key part of Tasmania's history—namely, the development and exploitation of Tasmania's hydro resources to provide cheap power for domestic and, more importantly, industrial use. The construction of Waddamana A was important as it demonstrated that hydro resources could be developed to provide reliable power for domestic and industrial purposes and, in particular, that power could be transmitted over the comparatively long distance from Waddamana to Hobart.

The difficulties the Hydro-Electric Power and Metallurgical Company experienced in constructing the project led directly to the involvement of government in the provision of electricity and the creation of the Hydro-Electric Department (later the Hydro-Electric Commission and, ultimately, Hydro Tasmania).

[1] Paul Davies Pty Ltd, 2004, Hydro Tasmania Heritage Study, report prepared for Hydro Tasmania.

The construction of Waddamana B Power Station was the direct result of linking Tasmanian politics to the development of hydro-electricity in the 1934 state election. This linking led to the construction of Tarraleah and Waddamana B.

The history of the construction of Waddamana B demonstrates the difficulty in undertaking a large engineering project during a world war.

From 1916 until 1934, Waddamana was the sole Power Station supplying the bulk of power to Tasmania's industry and, from 1934 until the 1950s, Waddamana still provided a significant amount of hydro power generated in the state. At the time of closing Waddamana A, the station was still contributing 17% of the overall power produced in Tasmania. The supply of low cost power was an important factor in attracting industry to Tasmania and, therefore, Waddamana played a critical role in the history of the development of Tasmania.

Criterion B: Demonstrates rare, uncommon or endangered aspects of Tasmania's heritage.

The Waddamana study area contains numerous items of technology (such as the inlet valves, turbines and generators) that are rare, largely because only a few such items were ever in use.

The formal entrance to Waddamana A and the timber construction of the Engineers' offices, lookout, stairs and control room are unique in such an industrial context and are, therefore, an unusual part of Tasmania's heritage.

Criterion C: Potential to yield information that will contribute to an understanding of Tasmania's history.

The Waddamana study area has considerable potential to yield information contributing to the understanding of Tasmanian history through the interpretation of Waddamana A and Waddamana B (including the movable cultural heritage items), to demonstrate the principles of electricity and its generation, the development of electrical technology and the impact of electricity on Tasmania over time.

Criterion D: Important as a representative in demonstrating the characteristics of a broader class of cultural places.

The Waddamana study area is important as it demonstrates key characteristics of a hydro-electric power station from the first half of the twentieth century. Waddamana A is virtually complete and very close to its original condition, including its original fit out. Waddamana B is less complete but the key elements of the processes and the machinery are still in situ, making it possible to demonstrate how the plant worked when commissioned. By comparing the two adjacent power stations, it is possible to demonstrate changes in technology during the years between the completion of Waddamana A and Waddamana B.

Criterion E: Important in demonstrating a high degree of creative or technical achievement.

The Waddamana study area demonstrates a high degree of technical achievement; firstly, through its role in the Great Lakes Scheme, which was the first scheme of its size in Australia, and secondly, the isolated nature of Waddamana meant that the actual construction of the buildings and transport of the plant to the site was extremely difficult and required extraordinary effort. This effort was repeated during the period 1940–1949 with the construction of Waddamana B, where the impact of World War II on materials, equipment and manpower made the construction of a power station an immensely challenging undertaking.

Criterion F: Strong or special meaning for any group or community because of social, cultural or spiritual associations.

The Waddamana study area has a special meaning to members of the community who worked for Hydro Tasmania (and its antecedent organisations) which is often expressed by visitors to the Waddamana Power Station Museum who see the place as important, either because they or their relatives worked at Waddamana.

The Waddamana study area also has special meaning for members of the Institution of Engineers which has awarded the Waddamana A Power Station an Australian Historic Engineering Plaque. The Australian Historic Engineering Plaqueing Program was established to acknowledge past engineering achievements and to draw public attention to the significant contributions engineers have made to society. Awarding of the plaque identifies Waddamana as being of special significance to engineers.

(It is not known whether the plaques on Turbines 2 and 3 at Waddamana B, commemorating the wartime struggle to construct and transport the turbines to Tasmania, are of current significance to ex-servicemen's organisations.)

Criterion G: A special association with the life or work of a person, a group or an organisation that was important in Tasmania's history.

The Waddamana study area and, in particular, the Waddamana A Power Station is important to Hydro Tasmania (and its antecedent organisations) as the first hydro-electric power station owned and operated by Hydro Tasmania, and for its role in the formation of the Hydro-Electric Department.

The Waddamana study area also has specific associations with the life and work of Sir John Butters, who, as John Henry Butters, was the first engineer involved in the design and construction of the Great Lakes Scheme when it was in private hands and, later, became head of the Hydro-Electric Department when the Tasmanian Government took over the scheme. Butters had a direct 'hands-on' involvement with the Waddamana study area as the engineer involved in the project design and was later knighted for his services to engineering.

Waddamana also has a minor but notable association with the Governors-General, State Governors and Premiers who played their roles in the various opening ceremonies.

5.3.1 Statement of Historic Cultural Heritage Significance

The Waddamana study area and the whole Great Lakes Scheme demonstrate a key part of Tasmania's history, namely the development and exploitation of Tasmania's hydro resources to provide cheap power for domestic and, more importantly, industrial use. From 1916 until 1934, Waddamana was the sole power station supplying the bulk of power to Tasmania's industry and, from 1934 until the 1950s, Waddamana still provided a significant amount of hydro power generated. Waddamana A was still contributing 17% of the overall power produced in Tasmania when it was closed.

The difficulties the Hydro-Electric Power and Metallurgical Company experienced in constructing the project led to the involvement of government in the provision of electricity and the creation of the Hydro-Electric Department (later the Hydro-Electric Commission and, in due course, Hydro Tasmania).

The construction of Waddamana B Power Station was the direct result of linking Tasmanian politics with the development of hydro-electricity in the 1934 state election. This linking led to the construction of Tarraleah and Waddamana B. The history of the construction of Waddamana B demonstrates the difficulty in undertaking a large engineering project during a world war.

Numerous items of technology, such as inlet valves, turbines and generators, contained in the Waddamana study area are rare largely because only a few such items were ever in use. The Waddamana study area is also important because it demonstrates the key characteristics of a hydro-electric power station from the first half of the twentieth century. Waddamana A is virtually complete and retains a high degree of integrity. Waddamana B is less complete but the key elements of the processes and machinery are still in situ, making it possible to demonstrate how the plant worked when commissioned and, by comparing the two Power Stations, it is possible to demonstrate changes in technology in the years between the completion of Waddamana A and Waddamana B.

The formal entrance to Waddamana A and the timber construction of the engineers' offices, lookout, stairs and control room are unique in such an industrial context and are therefore a unique part of Tasmania's heritage.

The Waddamana study area has considerable potential to yield information that contributes to the understanding of Tasmanian history. The principles of electricity and its generation, the development of electrical technology and the impact that electricity has had on Tasmania over time can be demonstrated through the interpretation of Waddamana A and Waddamana B (including the associated movable cultural heritage items).

The Waddamana study area has a special meaning to members of the community who worked for Hydro Tasmania (and its antecedent organisations) at the stations and because it was the first hydro-electric Power Station owned and operated by Hydro Tasmania. The Waddamana study area also has a special meaning to members of the Institution of Engineers who awarded the Waddamana A Power Station an Australian Historic Engineering Plaque.

The Waddamana study area has a specific association with the life and work of Sir John Butters, the first engineer involved in the design and construction of the Great Lakes Scheme when it was in private hands who, later, became head of the Hydro-Electric Department when the Tasmanian Government took over the scheme. Butters had a direct 'hands-on' involvement with the Waddamana study area as the engineer involved in the project design.

As the Waddamana study area meets all the historical cultural heritage significance criteria at a number of levels, the study area has a High level of historical cultural heritage significance to Tasmania.

5.4 Significance of Precincts or Individual Items

The assessment of precincts and elements within precincts has been undertaken by considering how each element contributes to the overall reasons why the Waddamana study area is considered to be of High historical cultural heritage significance. The rankings defined in Table 5.1 (above) have been assigned to each item within the precinct.

5.4.1 Precinct 1: Upper Penstocks

Precinct 1 contains the two sets of penstocks to the Waddamana Power Stations. The penstocks contribute to the historic cultural heritage of the Waddamana study area by demonstrating the link between Waddamana and the Great Lake, and the manner in which the water reached Waddamana. The penstocks seem to be entirely typical of their type, and in the case of Waddamana A, may not be original fabric. However, the penstocks in themselves have a reasonably significant visual character. When seen from the valley, they dominate the landscape in a way that the buildings do not. For these reasons, Precinct 1 is considered to have High historic cultural heritage significance.

Table 5.2 Precinct 1: Upper Penstocks significance ranking

Ref No.	Name	Ranking
1	Penstock to Waddamana A	High
2	Penstock to Waddamana B	High

5.4.2 Precinct 2: Waddamana A

Precinct 2 contains the Waddamana A Power Station which, in its fabric, embodies almost all the values that make the overall study area significant. This precinct is considered to have Very High historic cultural heritage significance.

Table 5.3 Precinct 2: Waddamana A significance ranking

Ref No.	Name	Ranking
3	Penstock and inlet valves	High
4	Turbine hall	Very High
5	Turbine hall—Overhead Crane	High
6	Turbine hall—Turbine 1	High
7	Turbine hall—Turbine 2	High
8	Turbine hall—Turbine 3	High
9	Turbine hall—Turbine 4	High
10	Turbine hall—Turbine 5	High
11	Turbine hall—Turbine 6	High
12	Turbine hall—Turbine 7	High
13	Turbine hall—Turbine 8	High
14	Turbine hall—Turbine 9	High
15	Turbine hall—Exciter 1	High
16	Turbine hall—Exciter 2	High
17	Turbine hall—Exciter 3	High
18	Turbine hall—Exciter 4	High
19	Switch gallery	High
20	Control room	High
21	Bus bar area	High
22	Relay room	Medium
23	Controls (under control room)	Intrusive
24	Battery room	Medium
25	Disabled toilet	Intrusive

Ref No.	Name	Ranking
26	Tail race under turbines	High
27	Hot air duct	High
28	Cold air duct	High
29	Oil tanks and pumps	High
30	Workshop	Very High
31	Engineers in Charge Office	Very High
32	General office	Very High
33	Shift Engineers' Office	Very High
34	Entrance hall	Very High
35	Engineers lookout and drawing office	Very High
36	Toilets	Medium
37	Stairs	Very High
38	Store room	High
39	Sling room	High
40	Switch yard	High
41	Annex	Medium
52	Tailrace	High
62	Entrance to Waddamana A	Very High

5.4.3 Precinct 3: Waddamana B

Precinct 3 contains Waddamana B Power Station which, in its fabric, demonstrates most of the values that make the overall study area significant. In isolation, Waddamana B would be considered to have high historic cultural heritage significance; however, its physical relationship with Waddamana A allows technological comparisons to be made and significantly enhances the ability of the whole study area to contribute to an overall understanding of this aspect of Tasmania's history. For these reasons, this precinct is considered to have very high historic cultural heritage significance.

Table 5.4 Precinct 3: Waddamana B significance ranking

Ref No.	Name	Ranking
42	Penstocks	High
43	Turbine hall	Very High
44	Turbine 1	High
45	Turbine 2	High
46	Turbine 3	High
47	Turbine 4	High
48	Pumps	High
49	Overhead crane	High
50	Hot air outlet	High
51	Cold air inlet	High
53	Tailrace under Waddamana B	High
54	Oil filter room	Medium
55	Electricians' workshop	Medium
56	Covered way to Waddamana A	High
57	Workshop	High
58	Tool store	Very High
59	Store	Medium
60	Waddamana B switch yard	Medium
61	Tailrace	High
68	Room over workshops	Medium

5.4.4 Precinct 4: Outside Workshop

Precinct 4 contains the archaeological remains of associated workshops. In the context of the history of Waddamana, the workshops played a minor role and, in any case, date from c1949. This area is considered to be of medium historic cultural heritage significance.

Table 5.5 Precinct 4: Outside Workshop Area significance ranking

Ref No.	Name	Ranking
63	Workshop area	Medium

5.4.5 Precinct 5: Transmission Lines

Precinct 5 contains the footings for the transmission towers that conveyed power from Waddamana A. As footings, they are incomplete entities. However, the line of transmission towers could be tracked using these footings, and therefore they have some potential to contribute information to an understanding of the Waddamana study area. It is for this reason they are considered to be of medium significance.

Table 5.6 Precinct 5: Transmission Lines significance ranking

Ref No.	Name	Ranking
64	Transmission lines	Medium
65	Row of pine trees	Low
67	Electrolytic lightening arrestor	High
69	Light poles	High

5.4.6 Precinct 6: Bush

Precinct 6 lacks any noteworthy cultural remains that contribute to the significance of the Waddamana study area. Equally, it also lacks intrusive elements and, for this reason, is assessed as being of neutral significance.

Table 5.7 Precinct: 6 Bush significance ranking

Ref No	Name	Ranking
66	Quarry site	Neutral

5.5 Significance of Movable Heritage Items

The assessment of the movable heritage items was a difficult task as it was not all apparent which items directly related to Waddamana. The approach taken was to evaluate each item in the context of the three themes of the collection. If the item appeared to be particularly rare or important in the context of the theme, it was considered to be significant; otherwise, it was considered to be contributory to (or illustrative of) the theme.

Ten items were identified as being significant. These are set out in the table below.

No.	Description	Location	Theme	Significance
26	Vavle on penstock (ex-Duck Creek)	Northeast wall	History of hydro-electricity	Significant
54	Control board, Shannon Power Station	Southwest wall, Waddamana A	The Great Lakes Scheme	Significant
53	Memorial Plaques	Western corner, Waddamana B	The Great Lakes Scheme	Significant
60	Shannon valve	Near stairs, Waddamana A	The Great Lakes Scheme	Significant
22	300KVA generator set	Bottom of stairs, northeast corner	Waddamana Power Stations	Significant
25	Vortex turbine and generator set and governor (ex-Duck Reach)	Northeast corner	History of hydro-electricity	Significant
48	Set of spanners to serve machines	Northwest wall, Waddamana A	Waddamana Power Stations	Significant
28	Untitled Sculpture (by James Vaughn)	East corner	History of hydro-electricity	Significant
29	Air compressor	Southeast wall	History of hydro-electricity	Significant
31	Survey display of surveying instruments and diorama	North corner	History of hydro-electricity	Significant

6.0 Constraints and Opportunities

This section of the report sets out the key constraints and opportunities that affect the Waddamana study area.

The following statements are not conclusions or recommendations but, rather, are observations relevant to the circumstances of the buildings, items and structures within the Waddamana study area and matters that require consideration and resolution. In themselves, none of these constraints or opportunities form conservation policy; rather, they represent a succinct synthesis of issues to be addressed in formulating conservation policy.

This section of the report does not and cannot address in detail any other constraints or opportunities that may be present or arise. These other constraints and opportunities include matters such as planning, ecology, water quality and geology.

6.1 Constraints and Opportunities arising from Historical Cultural Heritage Significance

The previous section of this Conservation Management Plan has identified that the Waddamana study area has a very high level of historical cultural heritage significance. This is a constraint in that an item at this level of historical cultural heritage significance will require careful management. However, the high level of significance of the Waddamana study area is also an opportunity to provide an interesting educational experience to interpret the history of the 'Hydro' and also the history and nature of electricity and its impact on Tasmanian society. It is also one of the relatively few historic sites in Tasmania offering a broader dimension of heritage than traditional colonial houses or convict places.

The Waddamana study area also exists in a broader cultural landscape context—that of the Great Lakes Scheme—and many of the key features of this scheme remain extant in the region and are relatively easily to access. Therefore, the opportunity exists to expand education and interpretation beyond the boundaries of the study area to include areas such as Penstock Lagoon, the canals into the lagoon, the site of the Shannon Power Station and Miena Dam.

6.1.1 Burra Charter Principles

The need to manage the historical cultural heritage significance of the Waddamana study area means that appropriate heritage practice should be followed. *The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance 1999* contains principles for the conservation of significant places and the management of change to a place. The Burra Charter provides specific guidance for physical and procedural actions that should occur in relation to places of high historic cultural heritage significance. Relevant principles include the following (terms specifically defined in the Burra Charter are presented in italics):

- The aim of the *conservation* of the *place* should be to retain the *cultural significance* including provision for its security, its *maintenance* and its future (Article 2).

- *Conservation* is based upon a respect for the existing *fabric* and should involve the least possible physical intervention. It should not distort the evidence provided by the *fabric* (Article 3).
- The conservation policy appropriate to a place must first be determined by an understanding of its *cultural significance* (Article 6).
- The conservation policy will determine which uses are compatible (Article 7).
- *Restoration* is appropriate only if there is sufficient evidence of an earlier state of the *fabric* and only if returning the *fabric* to that state reveals the *cultural significance* of the *place* (Article 13).
- *Restoration* is limited to the reassembling of displaced components or removal of accretions in accordance with Article 16 (Article 15).
- The contribution of all periods to the *place* must be respected. If a *place* includes the *fabric* from different periods, revealing the *fabric* of one period at the expense of another can only be justified if what is removed is of slight *cultural significance* and the *fabric* which is to be revealed is of much greater *cultural significance* (Article 16).
- *Reconstruction* is only appropriate where a *place* is incomplete through damage or alteration and where it is necessary for its survival, or where it reveals the *cultural significance* of the *place* as a whole (Article 17).
- *Reconstruction* is limited to the reproduction of *fabric*, the form of which is known from physical and/or documentary evidence. It should be identifiable on close inspection as new work (Article 19).
- *Adaptation* is acceptable where the *conservation* of the *place* cannot otherwise be achieved and where the *adaptation* does not substantially detract from its *cultural significance* (Article 20).
- *Adaptation* must be limited to that which is essential to a use for the *place* determined in accordance with Articles 6 and 7 (Article 21).
- Study of a *place* by any disturbance of the *fabric* … should be undertaken where necessary to provide data essential for decisions on the *conservation* of the *place* and/or to secure information about to be lost or made inaccessible through necessary *conservation* or other unavoidable action (Article 24).
- The organisation and individuals responsible for policy decisions must be named and responsibility taken for each such decision (Article 26).
- Appropriate professional direction must be maintained at all stages of the work and a log kept of new evidence and additional decisions recorded as in Article 25 (Article 27).
- The records required by Articles 23, 25, 26 and 27 of the Burra Charter should be placed in a permanent archive and made publicly available (Article 28).

6.2 Constraints and Opportunities Arising from Site Conditions

6.2.1 Location and Context

The Waddamana study area is located near the geographic centre of Tasmania; however, access to the area is perceived as being difficult, largely because of the sections of unsealed road leading to Waddamana after leaving the Highland Lake Road (A5). Two concerns commonly expressed regarding access to the Waddamana study area were the slippery nature of the unsealed road and the danger intrinsic to sharing a road with timber trucks. Apart from short unsealed sections, access from the north and the south is good, via well-made roads.

The Waddamana study area is adjacent to the Waddamana Field Study Centre (formerly Waddamana Village), which is owned by Frank and Helen Cooper. They provide both accommodation and education experiences for school students. In addition, Frank Cooper is the curator of the museum. Some of the museum infrastructure, such as car parking and picnic facilities, stands on land owned by the Coopers.

There is a mutual interdependence between the Waddamana Field Study Centre and the Waddamana study area. Management of the museum would be considerably more difficult without an on-site curator and the museum provides an added attraction and education experience to the Waddamana Field Centre.

6.2.2 Building Condition

Generally, the buildings are in good condition, although Waddamana A is clearly in better condition than Waddamana B. Daily opening of Waddamana A by the curator provides convenience access that enables minor repairs to be carried out; larger and more difficult repairs can be referred to Hydro Tasmania's maintenance crews for action. It would appear unlikely that Waddamana A will require any major maintenance in the short term (1–5 years).

6.2.3 Asbestos and Other Contamination

Some preliminary assessment of the asbestos and other contamination in the Waddamana study area has been undertaken and a further report is being undertaken in May 2006. In general, four contamination issues have been identified in the study area:

- presence of Underground Storage Tanks (UST);
- friable asbestos in tip sites (in Precinct 4);
- bonded asbestos cladding of Waddamana B; and
- possible polychlorinated biphenyls (PCB) contamination.[1]

[1] Based on discussion with Hydro Tasmania staff and sections of draft reports provided to the author.

The presence and location of USTs can be determined relatively easily by referring to historical records and by interviewing people who worked on the site. Verification of the location and possible decommissioning of such USTs should not prove a difficulty for the on-going management of the site.

The presence of friable asbestos in the tip sites located along the bank of the Ouse River (mainly in Precinct 4) is a hazard. However, public access to this area requires walking around the perimeter of the Power Stations (a difficult activity[2]). The actual risk from this hazard may be low and remediation not required. The risk to public health needs to be considered, taking both the hazardous nature of the friable asbestos and the difficulty of accessing the tip sites into account.

Waddamana B is clad in 'Fibrolite', a product of James Hardie Ltd, which is likely to contain asbestos fibres. Bonded asbestos is generally considered to pose a low risk; nonetheless, the material used is over 50 years old and subject to minor wear and tear, thus exposing friable asbestos. It is possible to treat asbestos cement sheeting to help keep it bonded; this may be an option for the long-term mothballing of Waddamana B.

Owing to its insulating qualities, asbestos is often found in underground conduits, pipes and switchboards, and as insulation around wires. It is likely that there is asbestos in both Power Stations. Clearly, the most suitable approach is to undertake an inspection to identify the asbestos and then have a risk analysis prepared by an appropriate specialist in order that the asbestos risk is identified and the means of management ascertained.

As PCBs were in the oils within electrical transformers, these transformers have been identified as one source of PCB contamination.[3] It is unclear whether or not PCB contamination has occurred within the Waddamana study area; nevertheless, if PCBs are found on site, they are likely to be present in the switchyards and areas where oil from the transformers was cleaned. Again, identification and risk analysis by an appropriate specialist should help in the management of this possible contamination.

In many cases contamination risks are at a low level, provided the material concerned is not disturbed, for example, by excavation. This is likely to be the case at Waddamana, although some items on display in the museum may be contaminated and will need to be assessed.

6.3 Owner Requirements and Proposed Use

6.3.1 Hydro Tasmania's Long Term Plans

There is no formal policy on the Waddamana study area within Hydro Tasmania. The heritage values of Waddamana A are recognised but it is also acknowledged that the administration and management of a museum is not a core business activity of Hydro Tasmania. At present, Hydro

[2] Involving several steep climbs. Frank Cooper accesses the fresh water pump in this location on a daily basis using his keys to go through the Power Station site; the pump is up stream of the tip sites.
[3] In discussion with Andrew Scanlon from Hydro Tasmania, who said that PCB oils were not used to any great extent in Tasmania.

Tasmania intends to continue operating the Waddamana Power Station Museum and provide funding for a curator to open the museum on a daily basis.

There is no single manager in Hydro Tasmania managing the site; however, an informal team from the Divisions of Public Relations, Land and Facilities and Environment and Sustainability manages the site. This team is not a formal team with defined role and responsibility, it does not meet on a regular basis and no minutes are kept. While this arrangement may be effective in some circumstances, it provides no strategic overview and policy guidance for the management of the site.

The heritage values of Waddamana B are not well recognised within Hydro Tasmania and the current plan is to mothball Waddamana B. Hydro Tasmania still uses Waddamana B on a limited basis, as do Transend Networks, who have a store there.

6.3.2 Tourism Context

In a regional context, Waddamana is within the Lake St Clair and Central Highlands district and on the 'Rivers Run' tourist route. Most visitors go to Lake St Clair rather than the Great Lakes; the majority being in the 'big tour' category of tourists in a hire car travelling around Tasmania for approximately two weeks. However, there is also a significant day visitor market from Hobart and it is these visitors who are identified as having a very high participation rate in nature and cultural heritage experiences. Tourists to the Great Lakes numbered 33,840 in 2004, or 4% of all visitors to Tasmania.[4]

Unfortunately, despite Waddamana's heritage values and the museum, it literally does not seem to be 'on the map' with respect to Tasmanian tourism studies. For example, it is only mentioned briefly as an attraction in an Appendix to the Tasmanian Attractions Study[5]; one of the reasons for this being that Waddamana is not on the key tourist routes identified in the Attractions study. Waddamana is identified as being off the 'Rivers Run Touring Route', which is a regional tourist group; however, there are no symbols identifying what facilities are offered at Waddamana.[6] This is a significant problem given that 49% of tourists visiting Tasmania go on touring holidays using hire cars.[7]

Waddamana does have the potential to become an 'attraction' owing to its high heritage values, unique heritage experience and proximity to the Great Lakes and Hobart. It could, in addition, be developed as part of a low-key tourist drive using the road from Waddamana to Miena to access some of the other features of the Great Lakes Scheme. The difficulty lies in raising the profile of Waddamana and in developing the tourism and educational potential of the study area. It is not clear

[4] Tourism Development Kit, Tourism Tasmania, August 2005, downloaded from www.tourismtasmania.com.au

[5] Reed, D, Hepper, J and Tilley P, 1999, The Tasmanian Attraction Study: an independent study of current Tasmanian tourist attractions and a vision for growth into the 21st century, December 1999, downloaded from www.tourismtasmania.com.au

[6] Waddamana Museum offers toilets and picnic facilities and accommodation may be available at the Waddamana Field Studies Centre.

[7] Trends, Performance, Forecasts, November 2005, Tourism Tasmania, Appendix, p 15, downloaded from www.tourismtasmania.com.au

whether Hydro Tasmania would be willing to undertake this role or whether it would be a potential role for the Waddamana Field Studies Centre (presupposing that they want an increase in visitor numbers).

A further point to be made is that the focus of the Waddamana Museum has to be defined as a basis for the on-going collection and interpretation policy. Hydro Tasmania staff have raised two alternatives:

- a museum focusing on Waddamana A, the founding on the Hydro and the Great Lakes Scheme; and/or
- a museum focusing on hydro-electricity and its impact in Tasmania.

In fact, some elements of the existing collection (such as the electric stoves) support the latter focus. Such a broad focus would also allow the incorporation of Waddamana B into the museum. A broader focus may also make the museum a more attractive tourism destination.

6.4 Statutory Requirements Related to Heritage

At present, the Waddamana study area is not registered on any heritage list and therefore it has no statutory protection.

6.5 Other Statutory Requirements

The Waddamana study area, the structures within it and the actions that take place there must all comply with relevant Tasmanian legislation covering matters such as building codes and occupational health and safety.

7.0 Conservation Policy

7.1 Introduction

Developing a conservation policy for the Waddamana study area requires a balanced resolution of issues outlined in the constraints and opportunities discussed above (Section 6.0). The very high historical cultural heritage significance of the place imposes an overarching obligation to prioritise the requirement to conserve those elements of the place that contribute to its historic cultural significance.

7.2 Organisation of this Section

Within this section, general policies relating to the Waddamana study area are discussed first, followed by specific policies applying to a precinct or an individual element within a precinct.

7.3 Overall Conservation Policy Aim

The overall aim for management of the Waddamana study area is that the whole site should be conserved as a place of very high historic cultural significance.

7.4 General Policies

Policy No	Policy	Reason
1	The Waddamana study area (excluding Precinct 6) should be considered in ongoing discussions between Hydro Tasmania and the Tasmanian Heritage Council for listing on the Tasmanian Heritage Register and for the establishment of heritage agreements for the ongoing use of the study area.	The study area has very high cultural heritage values; statutory protection would ensure that these are protected. Precinct 6 is not as significant as Precincts 1 to 5 and could be omitted from the boundary curtilage of any proposed listing. It is understood Hydro Tasmania is undertaking similar discussions for a number of other significant sites.
2	The study area should be conserved and managed in accordance with the principles and process of *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 1999* and relevant guidelines issued by Heritage Tasmania and with Hydro Tasmania's *Cultural Heritage Management Procedure* (EP 14).	The study area has Very High historical cultural heritage values; therefore, it should be managed according to best practice for cultural heritage management. It is recognised that Heritage Tasmania may, from time to time, issue guidelines that complement the Burra Charter principles and these should also be utilised in managing the study area.

Policy No	Policy	Reason
3	An overall manager or management team within Hydro Tasmania should manage the Waddamana study area.	The current informal management structures (see Section 6.3.2.1) are not sufficient to give appropriate direction to the management and conservation of the overall site and to ensure that the policies and recommendations in this Conservation Management Plan are implemented. (This arrangement need not preclude the existing role of the on site curator.)
4	The current use of the precincts in the study area, in particular the use of Waddamana A as a museum and the plan to mothball Waddamana B, are appropriate and should continue.	The current use of the precincts has no negative impact on the very high historic cultural significance of the Waddamana study area and provides excellent opportunities for interpretation of the historical cultural values of Waddamana A.
5	All potentially hazardous materials in the Waddamana study area need to be identified and managed appropriately.	Public safety and compliance with occupational health and safety standards. (This will require allocation of additional resources in the short term.)
6	An ongoing program of cyclical maintenance should be established by Hydro Tasmania.	Cyclical maintenance of heritage assets ensures their ongoing conservation and prevents small maintenance tasks that are not carried out in a timely manner from becoming major problems requiring costly repairs.
7	The current on site interpretation, while adequate, should be developed to make the best use of the Waddamana study area.	The best protection of the cultural significance of the study area will be afforded if the community value it and are encouraged to experience it. A better level of interpretation will enhance visitors' experience of the site, thereby maximising opportunities for educating the community about the history and technology associated with Waddamana.
8	The Conservation Management Plan for the Waddamana study area should be formally endorsed by Hydro Tasmania as the guiding docucument for future management and conservation of the Waddamana study area. The Conservation Management Plan should be reviewed in five years to ensure its continuing relevance.	Endorsement of the Conservation Management Plan will facilitate active management of the historic cultural heritage values of the site by Hydro Tasmania. Regular review will ensure that the Conservation Management Plan remains is relevant to changing circumstances.

7.5 Specific Precinct Policies

7.5.1 Precinct 1: Upper Penstocks

Policy	Reason
The management aim is to conserve the significant fabric (that is, the penstocks themselves) and the significant view of the penstocks. An ongoing program of cyclical maintenance, with the aim of preventing corrosion of the penstocks themselves (both inside and outside), should be undertaken.	The penstocks are of high significance and are important components of the site overall. Being separate from the main buildings, they are in danger of neglect.

7.5.2 Precinct 2: Waddamana A

Policy	Reason
The management aim for this precinct is to conserve the highly significant fabric within the precinct. The use of this precinct as a museum is endorsed, should be continued and, if possible, enhanced.	This precinct is considered to have very high cultural heritage significance and the use of Waddamana A as a museum respects and conserves the significant fabric and items in this precinct.
An overall plan for the development and operation of the Waddamana Museum is required. The plan should include such items as the aim or vision for the museum, its collection policy, interpretation, education and marketing.	Without such a development and operations plan, there will be no impetus to improve interpretation, no management of the significant items of movable cultural heritage in the museum collection, nor will there be any increase in the profile of the museum so as to encourage increased visitation.
A collection policy is required as an interim measure.	Material is being 'donated' to the museum without adequate consideration as to whether it is relevant to the museum, how it is to be displayed or if it contains hazardous material. A formal transfer of ownership agreement is required to prevent confusion arising between those items on loan to the museum and those donated. Such a policy would also allow the on site curator to refuse items that are not relevant to the collection.
All movable heritage items in the museum and in Waddamana B should be registered and tagged.	Identification and tagging will facilitate better management of the collection of movable heritage items and will clearly identify those items that are part of the museum collection.

7.5.3 Precinct 3: Waddamana B

Policy	Reason
The management aim for this precinct is to recognise the historic cultural heritage significance of Waddamana B in its own right and, in the context of the overall Waddamana study area, to conserve the fabric that contributes to that significance. The current management aim for Waddamana B is to mothball the building. This is understood to mean making good building defects that allow ingress of water, birds and animals, cleaning the interior, removing rubbish and then leaving the building vacant with minimal (but adequate) cyclical maintenance. This proposal is supported.	There is no current active use proposal or prospect for Waddamana B. Mothballing, as proposed, should not impact on the cultural heritage significance of the place and will maximise potential future options.
The turbines are of high historic cultural heritage significance and should be conserved as far as practicable.	The turbines are part of the historic cultural significance of the place. However, at present, the turbines appear as if they are a source of spare parts. Turbine 1 is partially disassembled. Turbine 4 is the most complete of the turbines and should be maintained as a complete example of this type of turbine.
Continued use of the storage area at Waddamana B by Transend Networks is appropriate. The use of other areas within the building may also be appropriate, subject to consideration of the impact of that use on the historic cultural heritage significance of Waddamana B.	Low-key use of Waddamana B enhances the security of the building and allows the immediate identification of items requiring maintenance. Continuing use of the area may also justify ongoing maintenance expenses.
Access to Waddamana B by visitors to the museum should be allowed in certain circumstances (such as small groups escorted by an appropriate person).	Visitor access will allow the further understanding and interpretation of the historic cultural heritage significance of Waddamana B.
The tool room at Waddamana B is of very high cultural heritage significance and needs to be retained as it is.	Removal of or additions to the tools will have a major negative impact on the significance of the tool room.
All museum items in Waddamana B need to be identified, tagged and placed in a designated area.	Active interpretation and management of the collection will clearly distinguish what is and what is not a museum item and will ensure those items are safely stored. At present, it is difficult to ascertain exactly what is a museum item.

Policy	Reason
In the long term, consideration should be given to formally incorporating Waddamana B into the Waddamana Museum.	Waddamana B is of high historic cultural heritage significance and, if combined with Waddamana A, would enhance the current museum, providing additional opportunities for visitor experience and on site interpretation.

7.5.4 Precinct 4: Outside Workshop

Minimal disturbance is the conservation aim for this area.

It is possible that some remediation work regarding contamination in this area may have to be undertaken. If this were the case, further assessment of the impact of these works would be required, followed by appropriate salvage archaeological documentation of the building remains that are affected.

7.5.5 Precinct 5: Transmission Lines

Minimal disturbance is the conservation aim for this area.

Ongoing maintenance of the grounds and of the light poles and lightening arrestor in this area is required in order to conserve their heritage significance.

A medium-term aim would be the interpretation of the transmission tower footings to enable visitors to the site to trace the route to which they belonged along the ground. (Colour coding might assist this process.)

7.5.6 Precinct 6: Bush

Minimal disturbance is the conservation aim for this area.

There are no conservation policies for this area.

7.6 Policies for Movable Cultural Material

Policy	Reason
The policy for site for movable cultural material is documentation and interpretation, as discussed in Section 7.4.2 (above).	To better manage the collection of movable heritage items and to clearly identify those items that are part of the museum collection.
A medium-term aim is to improve the interpretation of movable cultural heritage so that the relationship of each item to the overall interpretive stories is made more obvious and the interpretation is made more interesting.	Some items in the collection of movable cultural material are of significance; others, although of a contributory nature, can be the medium for interpreting aspects of the history of Waddamana, the Great Lakes Scheme or aspects of the history of hydro-electricity in Tasmania.

8.0 Implementation Strategies

8.1 General Conservation Policies

Policy 1 The Waddamana study area (excluding Precinct 6) should be considered in ongoing discussions between Hydro Tasmania and the Tasmanian Heritage Council for listing on the Tasmanian Heritage Register and for the establishment of heritage agreements for the on-going use of the study area.

Strategy/Action	Period
Prepare and lodge a nomination for the Waddamana study area.	Within 12 months

Policy 2 The study area should be conserved and managed in accordance with the principles and processes of *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 1999* and relevant guidelines issued by Heritage Tasmania and Hydro Tasmania.

Strategy/Action	Period
Ensure that policies and planning for the Waddamana study area incorporate the principles and processes of the Burra Charter, Heritage Tasmania, and Hydro Tasmania guidelines.	Ongoing
Adopt the procedure of undertaking a heritage impact assessment for all non-maintenance works at Waddamana.	Ongoing
Adopt the principle of archival recording prior to works being undertaken and the principle of thorough documentation of works that change the site.	Ongoing

Policy 3 An overall manager or management team within Hydro Tasmania should manage the Waddamana study area.

Strategy/Action	Period
Appoint an appropriate manager or management team.	With 12 months
Liaise with Frank Cooper at Waddamana.	Ongoing
Implement the Conservation Management Plan.	Ongoing as required

Policy 4 The current use of the precincts in the study area, in particular the use of Waddamana A as a museum and plan to mothball Waddamana B, are appropriate and should continue.

Strategy/Action	Period
Develop a plan for mothballing Waddamana B.	Within 6 months

Policy 5 All potentially hazardous materials in the Waddamana study area need to be identified and managed appropriately.

Strategy/Action	Period
Undertake an identification survey for hazardous materials within the Waddamana study area.	Within 12 months
Undertake a risk analysis associated with known hazardous materials and, if required, undertake appropriate actions.	Within 12 months

Policy 6 An on-going program of cyclical maintenance should be established by Hydro Tasmania.

Strategy/Action	Period
Maintain all significant buildings to a high standard to ensure that they remain sound and viable into the future.	Ongoing
Undertake a building condition inspection to identify current and on-going maintenance issues.	Within 12 months
Institute a program of systematic inspection of the buildings to be undertaken by the museum curator to ensure that gutters and downpipes are working, windows undamaged and that the roof and exterior cladding are securely intact.	Within 12 months

Policy 7 The current on site interpretation, whilst adequate, needs to be developed to make the best use of the Waddamana study area.

Strategy/Action	Period
Review the existing interpretation of the study area in conjunction with the policies for the museum with the aim of producing a strategy that encourages increased visitation to the site.	Within 12 months
Liaise with the Waddamana Field Studies Centre to explore mutually supportive interpretive and marketing goals.	Within 12 months
Consider linking the Waddamana study area with other sites relating to the Great Lakes Scheme.	Within 5 years

Policy 8 The Conservation Management Plan for the Waddamana study area should be formally endorsed by Hydro Tasmania as the guiding document for future management and conservation of the Waddamana study area but should be reviewed in five years to ensure its continuing relevance.

Strategy/Action	Period
Endorse this Conservation Management Plan as the guiding document for future management and conservation of the Waddamana study area.	Within 12 months
Ensure copies of this document are lodged, when required, with the Tasmanian Heritage Council (via Heritage Tasmania) and seek the Council's endorsement of the conservation policies and management guidelines.	Within 12 months
Make a copy of this conservation Management Plan publicly available through Hydro Tasmania.	Within 12 months
Ensure that the policies in this Conservation Management Plan are known and understood by relevant Hydro Tasmania staff, the relevant planning authorities and any contractors or others engaged to undertake any works at Waddamana.	Within 12 months

8.2 Precinct Specific Conservation Policies and Actions

8.2.1 Precinct 1: Upper Penstocks

An on-going program of cyclical maintenance should be undertaken with the aim of preventing corrosion of the penstocks themselves (both inside and outside).

Strategy/Action	Period
Inspect all the penstocks and identify the best long-term means of preventing corrosion of the steel pipes.	Within 2 years

8.2.2 Precinct 2: Waddamana A

The use of this precinct as a museum is endorsed, should be continued and, if possible, be enhanced.

The Waddamana Museum needs an overall plan for its development and operation. The plan should include such items as the aim or vision for the museum, its collection policy, interpretation, education and marketing.

Strategy/Action	Period
Develop a plan for the museum; museum studies students could possibly do this as a practical project.	Within 2 years

A collection policy is required as an interim measure.

Strategy/Action	Period
Develop a collection policy in consultation with appropriate professionals and Frank Cooper.	Within 12 months

All movable heritage items in the museum and in Waddamana B should be registered and tagged.

Strategy/Action	Period
Develop a register of movable cultural heritage and tag or otherwise identify such items held by the museum.	Within 2 years

8.2.3 Precinct 3: Waddamana B

The current management aim for Waddamana B is to mothball the building. This is understood is to mean making good building defects that allow ingress of water, birds and animals, cleaning the interior, removing rubbish and then leaving the building vacant. This proposal is supported.

Strategy/Action	Period
Undertake building condition inspection (as above).	Within 12 months
Remedy any defects.	Within 12 months
Continue minimal cyclical maintenance regime (as above).	Ongoing

The turbines are of high historic cultural heritage significance and should be conserved as far as practicable.

Strategy/Action	Period
Turbines 1–3 should at least be presented in such a way as to make them look as if they could work.	Within 12 months
Turbine 4 should be restored to as near working condition as possible.	Within 12 months

Continuing use of the storage area at Waddamana B by Transend Networks is appropriate. Use of other areas within the building may also be appropriate, subject to consideration of the impact of that use on the historic cultural heritage significance of Waddamana B.

Strategy/Action	Period
Transend Networks should be advised of the historic cultural heritage significance of Waddamana B so that their staff do not inadvertently damage the site.	Within 6 months
Other proposals to use Waddamana B that do not impact on its heritage significance and which may provide a small income stream should be encouraged.	Ongoing

Access to Waddamana B by visitors to the museum should be allowed in certain circumstances (such as small groups escorted by an appropriate person).

Strategy/Action	Period
'Behind the scenes' or 'hidden heritage' tours are an important segment of the market and, with appropriate guidance, it should be possible to take small groups in to Waddamana B or into the cold air duct of Waddamana A on special occasions (on the basis that staff are paid for by the visitors). The possibility of running these tours should be investigated.	Within 2 years
Allow visitors to look into Waddamana B from the end of the walkway linking Waddamana A and B.	Ongoing

The tool room at Waddamana B is of very high cultural heritage significance and needs to be retained as it is.

Strategy/Action	Period
Retain all existing movable heritage, furniture and documents in their present location.	Ongoing
Do not put anything else into the tool room.	Ongoing
Using oral history, document the tools in the room, their manufacture and use.	Within 5 years

All museum items in Waddamana B need to be identified, tagged and placed in a designated area.

Strategy/Action	Period
Develop a register of movable cultural heritage and tag or otherwise identify such items held by the museum.	Within 2 years

8.2.4 Precinct 4: Outside Workshop

Some remediation work regarding contamination in this area may have to be undertaken. If so, further assessment of the impact of this work would be required followed by appropriate salvage archaeological documentation of the building remains that are affected.

Strategy/Action	Period
The impact of any planned remediation work should be assessed through an archaeological impact assessment followed by an appropriate program of archaeological monitoring.	If required

8.2.5 Precinct 5: Transmission Lines

On-going maintenance of the grounds and of the light poles and lightening arrestor in this area is required in order to conserve their heritage significance.

Strategy/Action	Period
Incorporate the on-going maintenance of the grounds, the light poles and lightening arrestor into the overall cyclical maintenance plan for the Waddamana study area.	Within 12 months

A medium-term aim would be to interpret the transmission tower footings so that the route to which they belonged could be traced on the ground (possibly by colour coding).

Strategy/Action	Period
Interpret the location of the transmission towers in this area.	Within 5 years

8.2.6 Precinct 6: Bush

There are no conservation policies for this area.

8.2.7 Policies for Movable Cultural Heritage Material

Many of these strategies are covered by those above, in particular those to do with the museum.

Strategy/Action	Period
Identify, catalogue and register all movable heritage in the Waddamana study area.	Within 2 years
Develop an interim collection policy.	Within 12 months
Undertake any conservation works necessary to site records and archives.	Within 2 years

9.0 Bibliography

9.1 Published Works and Reports

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Davies, P 2006, 'Lake Margaret Power Scheme: A Conservation Management Plan Volume 2', report to Hydro Tasmania by Paul Davies Pty Ltd.

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Scanlon, A 2003, *The power of Nature,* Hobart, Hydro Tasmania.

9.2 Maps and Plans

(Note: one frustration in dealing with plans is the lack of dates on plans; typically, the title block has initials of draftsmen and their supervisors but there is no provision for the date on which the plan is signed off. Most plans are held in Hydro Tasmania's Hobart offices; however, significant collections of plans relating to Waddamana and Shannon are held in the engineers' office at Waddamana A.)

Plan of Survey Annexure Sheet SP 133339, 4/4/99.

Power Station Ext. Waddamana Assembly Diagrams Trusses T1 to 13, DE148, 25/6/1920.

Tasmanian Government Power Station Extension, 8000 BHP Impulse Turbine, Cross Section, 01208, Boving and Co London.

Tasmanian Government Power Station Extension, 8000 BHP Impulse Turbine Plan, 01218, Boving and Co London.

Waddamana 'A' and 'B' Power Stations, General Arrangement of Stations, A8008.

Waddamana A Power Station, Complete Layout X7839.

Waddamana B Power Station, General Arrangement of Machine Floor etc, 29/08/1949, A7509.

Waddamana Pipelines, General Index Plan 1944, X7419.

Waddamana Power Station 'A', Third Extension to Control Room, A2798, 21/03/1956.

Waddamana Power Station, Completion of Excavation and Drainage, 2794 (signed by Butters).

Waddamana Power Station, Complete Layout 3295 (same plan reproduced in Engineering 1924).

Waddamana Power Station, Extension Section of Switchgear, 2096 (signed by Butters).

Waddamana Power Station, Layout of Workshop and Offices, 3224 (signed by Butters).

Waddamana Village, 40ft Detail Plan, A7460, 27/07/1945.

9.3 Archived Files

These are a series of files from the Hydro-Electric Department and the Hydro-Electric Commission held in the Tasmanian State Archives but accessed through the Library of Hydro Tasmania. There are further files but these were not examined in the course of this project due to lack of time.

EG106	WADDAMANA POWER STATION GENERALLY	1945–1960	Rec	TJN607
EG106	WADDAMANA POWER STATION GENERALLY	1961–1990	Rec	TJN608
19/2	WADDAMANA POWER STATION DESIGN 1948–1957	1957	Rec	TJN713 TJN714
19/2B	WADDAMANA POWER STATION GENERAL	1948	Rec	TJN713
W.0.0.1.	Waddamana	1958	Rec	TJN793
W.0.0.1.1.	Waddamana No. 2	1985	Rec	TJN793
DP13	WADDAMANA PIPELINES GENERALLY	1954–1989	Rec	TJN647
PC 1	WADDAMANA 'B' PENSTOCKS	1987–1992	Rec	TJN2881
DX8-14	WADDAMANA B PROJECT GENERALLY	1929–1957	AA 520/106	
DR120-1	WADDAMANA 'B' POWER STATION BUILDING	1941–1970	Rec	TJN443
DR319	WADDAMANA POWER STATION BUILDING	1920–1924	Rec	TJN484
PG28	WADDAMANA GENERATING PLANT CONTRACT	1913–1979	Rec	TJN1217—C5505914083
EG106	WADDAMANA POWER STATION GENERALLY	1945–1960	Rec	TJN607
EG106	WADDAMANA POWER STATION GENERALLY	1961–1990	Rec	TJN608
PG80-3	TURBINES—WADDAMANA B POWER STATION	1941–1942	Rec	TJN1222
PG409	WADDAMANA—TURBINES—SIEMENS—GENERAL	1940–1942	Rec	TJN1321
PG409	WADDAMANA—TURBINES—SIEMENS—GENERAL	1942–1946	Rec	TJN1322

PG409	WADDAMANA—TURBINES—SIEMENS—GENERAL	1946–1981	Rec	TJN1323
PG454	WADDAMANA—BOVING AND CO—EXCITATION SETS	1940–1966	Rec	TJN1323
PG454	WADDAMANA—WATER TURBINE GENERATORS	1940–1942	Rec	TJN1323
	Waddamana Power Station	1921	Rec	TJN1602
S209	Waddamana Power Station	1965–1974	Rec	TJN1790
	WADDAMANA STEP UP STATION DESIGN	1921	Rec	TJN2209
	WADDAMANA A AND WADDAMANA B POWER STATION	1934–1945	Rec	TJN2209
7.3	Waddamana B Power Station Study Proposal	1992	Rec	TJN1855
P1.0	WADDAMANA—CLOSING WADDAMANA A	1965	Rec	TJN938
DW8-14	WADDAMANA EXTENSIONS	1918	Rec	TJN816
DW75-8	WADDAMANA PROJECT	1912–1974	Rec	TJN817
DW75-9	WADDAMANA PROJECT COSTS	1919	Rec	TJN817
WAD 1/08	Waddamana Power Development 'B' Power Station Tailrace Model	31/12/1944	Rec	TJN799
TE469	ESSANTEE SWITCHGEAR PTY LTD—ED469–ED469—110KV SWITCHGEAR TARRALEAH BOYER ELECTRONA SUBSTATION AND WADDAMANA B POWER STATION	1939–1957	Rec	TJN70

There were also five volumes of Waddamana photographs held in the Hydro Tasmania Library which were also examined.

10.0 Appendices

Appendix A

Site Data Sheets

Appendix B

Movable Heritage Audit

Appendix A

Site Data Sheets

WADDAMANA
POWER STATION

Godden Mackay Logan
Heritage Consultants

APPENDIX A: BUILT HERITAGE SITE DATA SHEETS

BH01

Name Penstock to Waddamana A

Precinct Precinct 1 Upper Penstocks

Description Penstocks from the Hilltop valve house to Waddamana A. The pipes are partly removed particularly on the lower slopes where access is easier.

Historical Summary These are more recent pipes, the originals were wood stave pipes. There were six pipes: one 20", two 36", two 48" and one 50". These were anchored as they came down the slope.

Comments The pipes have a high visual impact as they come down the hill. There is a need to consider a program of mothballing and conserving the pipes and keeping vegetation down around the pipes.

Condition Altered sympathetically

Significance High

BH02

Name Penstock to Waddamana B

Precinct Precinct 1 Upper Penstocks

Description Four 48" pipes running down the slope from the Hilltop valve house and anchors

Historical Summary Installed during the 1940s.

Comments The line seems to be complete

Condition Good

Significance High

BH03

Name Penstock and Inlet valves

Precinct Precinct 2 Waddamana A

Description Seven penstocks from precinct boundary run down to the north-west side of the Turbine Hall and each has an inlet valve. All the penstocks and inlet are linked by a common pipe allowing adjustment of water if one penstock was out of use. A pipe taps two of the older penstocks to take water to the exciters.

Historical Summary The smaller penstocks and inlets run to the earliest turbines.

Comments Not complete as pieces are removed. A wombat lives in one of the penstocks and could undermine or disturb the foundations, or the penstocks themselves.

Condition Altered sympathetically

Significance High

BH04

Name Turbine Hall

Precinct Precinct 2 Waddamana A

Description A long rectangular building orientated with its longest axis N-E to S-W. The building is approximately 264.5ft (80.62m) long and 58.5ft (17.82m) wide. The building is steel framed with the roof formed by 21 (including the ends) modified Fink trusses with five rafters and a raised ridge to provide ventilation. Each truss is linked by two I beams and has its joints gusseted to provide lateral stability. Each truss rests on I beam columns which are bolted to the concrete floor. Steel L shaped beams run between each columns. The corrugated galvanised iron cladding is attached to this by hook bolts. There is a sliding door at the southern end of the building. There are two levels of windows. The upper level windows consist of sets of 30 panes in two frames of 15 each in every second bay on the long axis of the building. At the lower level there are sets of 100 panes in two sets in the middle of each set is a bank of 9 panes open out. Windows are at the lower level of the north west and north east side of the building.

Historical Summary Constructed in two stages. The first stage was complete by 1916 and then enlarged in 1922 to its present size. Originally the roof had skylights which were replaced by side windows during the 1940s. At the same time the floor appears to have finished in psudo-tiling at this time along with the partial lining of the walls by masonite.

Comments The building is in good condition.

Condition Good

Significance Very High

BH05

Name Turbine Hall - Overhead Crane

Precinct Precinct 2 Waddamana A

Description A travelling overhead electrical crane is installed in the Turbine Hall. The lifting capacity is 30 tons with a smaller hook. The crane is non-operational but can move along its traveller. The crane is mounted in a separate frame of I beams attached to the I beam columns forming the walls of the Turbine Hall.

Historical Summary The crane is likely to have been installed at least during the 1920's expansion but possibly when the building was constructed c1916.

Comments A good example of its type

Condition Good

Significance High

BH06

Name Turbine Hall - Turbine 1

Precinct Precinct 2 Waddamana A

Description This is 5000HP Boving single jet horizontal shaft Pelton wheel turbine, 375RPM driving a 4050 KVA British Westinghouse alternator.

Historical Summary In service May 1915

Comments This turbine and generator set is in a partially disassembled form with interpretation as part of the Museum

Condition Good

Significance High

BH07

Name Turbine Hall - Turbine 2

Precinct Precinct 2 Waddamana A

Description This is 5000HP Boving single jet horizontal shaft Pelton wheel turbine, 375RPM driving a 4050 KVA British Westinghouse alternator.

Historical Summary In service May 1915

Comments

Condition Good

Significance High

BH08

Name Turbine Hall - Turbine 3

Precinct Precinct 2 Waddamana A

Description A Boving two jet 8000 HP turbine coupled to a 7050 KVA General Electric (USA) alternator.

Historical Summary In service November 1911

Comments

Condition Good

Significance High

BH09

Name Turbine Hall - Turbine 4

Precinct Precinct 2 Waddamana A

Description A Boving two jet 8000 HP turbine coupled to a 7050 KVA General Electric (USA) alternator

Historical Summary In service December 1921

Comments

Condition Good

Significance High

BH10

Name Turbine Hall - Turbine 5

Precinct Precinct 2 Waddamana A

Description A Boving two jet 8000 HP turbine coupled to a 7050 KVA General Electric (USA) alternator

Historical Summary In service February 1922

Comments

Condition Good

Significance High

BH11

Name Turbine Hall - Turbine 6

Precinct Precinct 2 Waddamana A

Description A Boving two jet 8000 HP turbine coupled to a 7050 KVA General Electric (USA) alternator

Historical Summary In service May 1922

Comments

Condition Good

Significance High

BH12

Name Turbine Hall - Turbine 7

Precinct Precinct 2 Waddamana A

Description A Boving two jet 8000 HP turbine coupled to a 7050 KVA General Electric (USA) alternator

Historical Summary In Service November 1922

Comments

Condition Good

Significance High

BH13

Name Turbine Hall - Turbine 8

Precinct Precinct 2 Waddamana A

Description A Boving two jet 8000 HP turbine coupled to a 7050 KVA General Electric (USA) alternator

Historical Summary In service April 1923

Comments

Condition Good

Significance High

BH14

Name Turbine Hall - Turbine 9

Precinct Precinct 2 Waddamana A

Description A Boving two jet 8000 HP turbine coupled to a 7050 KVA General Electric (USA) alternator

Historical Summary In Service February 1923

Comments Interpreted in Museum

Condition Good

Significance High

BH15

Name Turbine Hall - Exciter 1

Precinct Precinct 2 Waddamana A

Description 120KWA 110volt British Westinghouse DC exciters coupled to a Boving single jet horizontal turbines supplied from a 12inch (30cm) bus pipe

Historical Summary In service May 1916

Comments Interpreted in Museum

Condition Good

Significance High

BH16

Name Turbine Hall - Exciter 2

Precinct Precinct 2 Waddamana A

Description 120KWA 110volt British Westinghouse DC exciters coupled to a Boving single jet horizontal turbines supplied from a 12inch (30cm) bus pipe

Historical Summary In service May 1916

Comments

Condition Good

Significance High

BH17

Name Turbine Hall - Exciter 3

Precinct Precinct 2 Waddamana A

Description Boving Pelton turbines driving 300 KVA General Electric generator

Historical Summary Replaced earlier exciters in late 1940s

Comments

Condition Good

Significance High

BH18

Name Turbine Hall - Exciter 4

Precinct Precinct 2 Waddamana A

Description Boving Pelton turbines driving 300 KVA General Electric generator

Historical Summary Replaced earlier exciters in late 1940s

Comments

Condition Good

Significance High

BH19

Name Switch Gallery

Precinct Precinct 2 Waddamana A

Description This is the top of a concrete structure erected along the south east wall of the Turbine Hall. On the top of the structure were three banks of circuit breakers. Access to the gallery was by a double stair case on the north western side of the gallery. Another stair is located at the north east end of the gallery.

Historical Summary The gallery was part of the 1922 construction works.

Comments Two of the galleries have been removed and replaced by museum cases containing the collection of electrical appliances and equipment.

Condition Altered sympathetically

Significance High

BH20

Name Control room

Precinct Precinct 2 Waddamana A

Description This is located on top of a concrete structure adjacent to the switch gallery. The control room is enclosed in elaborate timber panelling and glazing. Supposedly this is in Tasmanian Blackwood. Behind the class are the controls for Waddamana A & B and possibly those for Shannon. There is an interesting switchboard which connects the control room to other power stations in the network.

Historical Summary Constructed in 1922 and then enlarged to take Waddamana B. Various items have been modernised and replaced. Still partly active. Altered to allow museum visitors to look in.

Comments Could be better interpreted.

Condition Altered sympathetically

Significance High

BH21

Name Bus bar area

Precinct Precinct 2 Waddamana A

Description Located in the concrete structure supporting the Switch Gallery and Control Room

Historical Summary This space would have had the Auxiliary and Main buss bars , the power from the turbines flowing through this area through the circuit breakers in the switch gallery and then down to the main bus bars and out to the transformers. All electrical equipment has been removed from this space leaving some of the mountings

Comments Now used for storage

Condition Altered unsympathetically

Significance High

BH22

Name Relay Room

Precinct Precinct 2 Waddamana A

Description This is located adjacent to the Control Room

Historical Summary A recent addition mirroring the decorative treatment of the control room. All relays have been removed and the space is empty.

Comments This space is vacant and all equipment removed.

Condition Altered unsympathetically

Significance Medium

BH23

Name Controls

Precinct Precinct 2 Waddamana A

Description A modern set of controls occupying space where the bus bars would have been.

Historical Summary Modern - still active

Comments

Condition

Significance Intrusive

BH24

Name Battery Room

Precinct Precinct 2 Waddamana A

Description Located under the control room and off the Turbine Hall.

Historical Summary This space contained a bank of lead acid batteries which provided a back up power supply in case of emergency.

Comments

Condition Good

Significance Medium

BH25

Name Disabled Toilet

Precinct Precinct 2 Waddamana A

Description A modern toilet constructed in the northern eastern end of the Bus bar area.

Historical Summary Recent

Comments

Condition Good

Significance Intrusive

BH26

Name Tail race under turbines

Precinct Precinct 2 Waddamana A

Description Located under the turbines this race collects used water and joins with the tail race outside the building. The passage runs along the long axis of the Turbine Hall under the turbines.

Historical Summary

Comments Inaccessible

Condition Not known

Significance High

BH27

Name Hot Air duct

Precinct Precinct 2 Waddamana A

Description This was constructed under the generators to allow venting of hot air which was a by-product of the generating process. The passage runs along the long axis of the Turbine Hall under the generators.

Historical Summary

Comments Not accessible

Condition Not known

Significance High

BH28

Name Cold Air Duct

Precinct Precinct 2 Waddamana A

Description This passage runs along the long axis of the Turbine Hall adjacent to the south eastern wall. The passage narrows significantly at its southern end probably reflecting the earlier 1916 construction. There are spaces off the main passage which are mostly used for storage although one contains live electrical equipment. Some plans identify this area as containing a DC bus bar (possibly to excite the generators) and various rheostats.

Historical Summary Originally part of 1916 station and then extended in 1922.

Comments Some of the wiring is coated in a white material probably asbestos insulation.

Condition Good

Significance High

BH29

Name Oil Tanks and Pumps

Precinct Precinct 2 Waddamana A

Description Located in the underground level off the Cold air duct, this area was used for filtering oil. It contains a ships tank used as an oil container and a "Valvoline Oil Co, Turners Patent Oil Filter". Not clear whether the oil was used for lubricating the machinery or in the electrical gear. The plans suggest it was oil from the transformers.

Historical Summary Shown on plans from the 1922 period.

Comments Potential for PCB contamination?

Condition Good

Significance High

BH30

Name Workshop

Precinct Precinct 2 Waddamana A

Description Located in the bottom level of the 1922 annex, this area is off the Turbine Hall and contains a tramway in from the switchyard, a turntable and a tramway out into the Turbine Hall. This allowed transformers and other heavy items from the Switch Yard to be brought into the workshop area for repair or transfer to the Turbine room where the overhead crane could lift them onto a truck for transport elsewhere for repair. A bench and lathe were located in the workshop. Access to the Sling room and the Store room are off this room

Historical Summary Constructed in 1922. It seems that the toilet upstairs has been enlarged to intrude into this area.

Comments

Condition Good

Significance Very High

BH31

Name Engineers in Charge Office

Precinct Precinct 2 Waddamana A

Description Located in the top level of the 1922 annex, this area, like all the top level is fitted out in Blackwood panelling. Office contains two plan presses containing numerous plans of Waddamana, mainly electrical.

Historical Summary The office is fitted out as an early 20th century office complete with dummy engineer.

Comments

Condition Good

Significance Very High

BH32

Name General Office

Precinct Precinct 2 Waddamana A

Description Located in the top level of the 1922 annex, this area, like all the top level is fitted out in Blackwood panelling. Office contains important albums of historic photos and books of historic plans.

Historical Summary Fitted out as historical office, not sure whether having a display depicting a female working in the office is authentic though.

Comments

Condition Good

Significance Very High

BH33

Name Shift engineers Office

Precinct Precinct 2 Waddamana A

Description Located in the top level of the 1922 annex, this area, like all the top level is fitted out in Blackwood panelling.

Historical Summary

Comments Now used as crib room for museum staff

Condition Good

Significance Very High

BH34

Name Entrance Hall

Precinct Precinct 2 Waddamana A

Description Located in the top level of the 1922 annex, this area, like all the top level is fitted out in Blackwood panelling.

Historical Summary

Comments The wooden panelling of this area is an interesting contrast with the rest of Waddamana A which is concrete and steel.

Condition Good

Significance Very High

BH35

Name Engineers Lookout and Drawing office

Precinct Precinct 2 Waddamana A

Description Located in the top level of the 1922 annex, this area, like all the top level is fitted out in Blackwood panelling. It is difficult to imagine what the engineer could actually see from here even in 1922 as the control room would have obstructed the view of the Turbine Hall.

Historical Summary The lookout and the stairs under it are extremely elaborate constructions totally overblown for the functions they are to perform and can only be interpreted as emphasizing the status of the engineer.

Comments Too narrow to photograph from inside.

Condition Good

Significance Very High

BH36

Name Toilets

Precinct Precinct 2 Waddamana A

Description Located in the top level of the 1922 annex, this area, like all the top level is fitted out in Blackwood panelling

Historical Summary The toilets seem to have been extended into the roof space of the workshop. The date of this extension is not known - possibly 1940s??

Comments

Condition Good

Significance Medium

BH37

Name Lookout and Stairs

Precinct Precinct 2 Waddamana A

Description Located in the top level of the 1922 annex, this area, like all the top level is fitted out in Blackwood panelling

Historical Summary The lookout and the stairs under it are extremely elaborate constructions totally overblown for the functions they are to perform and can only be interpreted as emphasizing the status of the engineer.

Comments

Condition Good

Significance Very High

BH38

Name Store Room

Precinct Precinct 2 Waddamana A

Description Lower level of 1922 building with access to Turbine Hall and Workshop. Standard store room with shelves containing tools and spared for the Power Station. Contains a concrete structure called 'the vault' which contains paper records from the Power Station.

Historical Summary

Comments The vault is probably not fireproof.

Condition Good

Significance High

BH39

Name Sling Room

Precinct Precinct 2 Waddamana A

Description Lower level of 1922 building with access to the Workshop. Standard store room with bench shelves

Historical Summary From its name it presumably contained slings for lifting items in the Power Station

Comments

Condition Good

Significance High

BH40

Name Switch yard

Precinct Precinct 2 Waddamana A

Description The switch yard is located on the south eastern side of the Power Station. It contained five separate elements. There are; a bank of 2333KVA transformers on concrete plinths, a tramway for transporting transformers, 88kv Transfer bus, circuit breakers and switch gear and transmission lines to Risdon via Creek Road, Risdon via Bedlam Walls, Longford and Shannon substations.

Historical Summary Constructed in 1922 to replace earlier switch yard and to cope with the expanded Power Station. Most of the equipment is removed.

Comments Possibly contaminated although this would need to be verified.

Condition Poor

Significance High

BH41

Name Annex

Precinct Precinct 2 Waddamana A

Description An annex at the north-east end of the Power Station was not accessible

Historical Summary Possibly contained pumped and air inlets

Comments

Condition Not known

Significance Medium

BH42

Name Penstocks

Precinct Precinct 3 Waddamana B

Description The Waddamana B penstocks separate into four distinct lines from anchor 28 (just inside the boundary fence and each run to their individual turbine. There is no interconnecting pipe arrangement. At the entrance to the building the penstocks are anchored by Anchor 29.

Historical Summary The penstocks were originally constructed by Hume Steel. In contract to those entering Waddamana A these penstocks lack a system of inlet valves and accordingly the pipe work is much simpler.

Comments The penstocks are complete

Condition Good

Significance High

BH43

Name Turbine Hall

Precinct Precinct 3 Waddamana B

Description The main building of the Waddamana B Power Station is the Turbine Hall which is 203.5 ft (62.03m) long and 38ft (11.58m) wide. The roof is gable ended formed by 12 Fink trusses resting on I beam columns bolted to the concrete floor. Stud walls were formed by U shaped metal beams bolted to the columns. The exterior walls were from “Fibrolite” corrugated asbestos cement sheeting which were attached to the studs by hook bolts. The roof was also clad in “Fibrolite ” attached to 10 rafters on each pitch.

There are extensive sets of windows. In the upper level there are windows in every bay formed by the columns. At the lower level there are alternating bays of windows and air vents along the long axis.

The Turbine Hall rests on extensive concrete foundations which incorporate passages for air cooling the generators, tailraces for the turbines and mountings for the fours sets of turbines and generators.

Historical Summary Construction of the building commenced in 1941 and it was decided to extend the building in 1942 and 1943. In 1944 there was some concern that the building structure was not sufficiently latterly braced.

Comments The building is largely unused although it is evident that there is some access to the building on an on-going basis by Hydro Tasmania staff and Transend staff accessing their storage area.

Condition Good

Significance Very High

BH44

Name Turbine 1

Precinct Precinct 3 Waddamana B

Description One 16,700 brake horsepower, four jet, single casing, double wheel impulse turbine directly coupled to one 16,000 KVA, 11,000 volt, three-phase, 80 cycle, 500 RPM horizontal shaft alternator, and an exciter coupled to the end of the shaft. Manufactured by English Electric on behalf of Siemens (Aust).

Historical Summary Installed November 1949

Comments Seems to have been largely disassembled

Condition Poor

Significance High

BH45

Name Turbine 2

Precinct Precinct 3 Waddamana B

Description One 16,700 brake horsepower, four jet, single casing, double wheel impulse turbine directly coupled to one 16,000 KVA…11,000 volt, three-phase, 80 cycle, 500 RPM horizontal shaft alternator, and an exciter coupled to the end of the shaft. Manufactured by English Electric on behalf of Siemens (Aust) .

Historical Summary Installed May 1946, this turbine has a comparative plaque "This tablet commemorates the building of this unit by the workers of Great Britain and its transportation to Tasmania by British seaman during the war years, 1939-1944"

Comments

Condition Fair

Significance High

BH46

Name Turbine 3

Precinct Precinct 3 Waddamana B

Description One 16,700 brake horsepower, four jet, single casing, double wheel impulse turbine directly coupled to one 16,000 KVA…11,000 volt, three-phase, 80 cycle, 500 RPM horizontal shaft alternator, and an exciter coupled to the end of the shaft. Manufactured by English Electric on behalf of Siemens (Aust) .

Historical Summary Installed February 1945, this turbine has a comparative plaque "This tablet commemorates the building of this unit by the workers of Great Britain and its transportation to Tasmania by British seaman during the war years, 1939-1944"

Comments

Condition Fair

Significance High

BH47

Name Turbine 4

Precinct Precinct 3 Waddamana B

Description One 16,700 brake horsepower, four jet, single casing, double wheel impulse turbine directly coupled to one 16,000 KVA…11,000 volt, three-phase, 80 cycle, 500 RPM horizontal shaft alternator, and an exciter coupled to the end of the shaft. Manufactured by English Electric on behalf of Siemens (Aust) .

Historical Summary Installed January 1944

Comments This turbine seems to be the most complete of the four.

Condition Good

Significance High

BH48

Name Pumps

Precinct Precinct 3 Waddamana B

Description Two small pumps located in the middle of the Turbine hall. These acted to pump out sump drainage and discharge it into the tailrace.

Historical Summary Installed in Waddamana B from the start.

Comments

Condition Good

Significance High

BH49

Name Overhead Crane

Precinct Precinct 3 Waddamana B

Description A Malcolm Moore travelling overhead electrical crane is installed in the Turbine Hall. The lifting capacity is 50 tons with a smaller hook. The crane is mounted in a separate frame of I beams attached to the I beam columns forming the walls of the Turbine Hall.

Historical Summary

Comments It is not clear whether the crane is operational or not

Condition Good

Significance High

BH50

Name Hot Air Outlet

Precinct Precinct 3 Waddamana B

Description There are four hot air outlets on the north east side of the turbine hall at Waddamana B. They consist of a concrete rectangular structure with wooden slats to admit air. The air is drawn from under the generators and flows out through the outlets

Historical Summary Part of the original design of the building

Comments The air flows in a different direction to that of the water

Condition Good

Significance High

BH51

Name Cold Air Inlet

Precinct Precinct 3 Waddamana B

Description There are four cold air inlets located along the south west side of Waddamana B. They are of concrete construction and the air is drawn through wooden slats and through banks of filters. Next to the filters there are electrical controls for the generators. These are located in the common wall between the Inlet walls and the Turbine Hall walls. There are steps to go into the cold air ducts but these were not inspected.

Historical Summary Part of the original design.

Comments

Condition Good

Significance High

BH52

Name Tailrace

Precinct Precinct 2 Waddamana A

Description The tailrace leaves the south west end of Waddamana A and runs straight to the Ouse River

Historical Summary This was part of the original construction

Comments Mostly outside the land owned by Hydro Tasmania but is in a dedicated easement.

Condition Good

Significance High

BH53

Name Tailrace under Waddamana B

Precinct Precinct 3 Waddamana B

Description The tailrace from under the turbines runs to the southwest under the turbine hall and all four join to form the main tailrace that runs parallel to the south west wall of the Power Station.

Historical Summary

Comments Not inspected

Condition Not known

Significance High

BH54

Name Oil filter Room

Precinct Precinct 3 Waddamana B

Description Small, skillion roofed annex on the south-east corner of the main turbine hall. Dimensions 13' 8" (4.17m) by 14' 6" (4.42m)

Historical Summary Identified as oil filter room. No evidence of this function is in the room today

Comments

Condition Good

Significance Medium

BH55

Name Electricians workshop

Precinct Precinct 3 Waddamana B

Description Small, skillion roofed annex on the north east corner of the main turbine hall. Dimensions 13' 8" (4.17m) by 14' 6" (4.42m)

Historical Summary Identified on a plan from 1949 as electricians workshop. Still used as a crib room.

Comments

Condition Good

Significance Medium

BH56

Name Covered way to Waddamana A

Precinct Precinct 3 Waddamana B

Description Steel framed with asbestos cement sheeting cladding running between Waddamana A and B over Waddamana A penstocks.

Historical Summary Now has some large windows which seem to be of recent origin.

Comments

Condition Good

Significance High

BH57

Name Workshop

Precinct Precinct 3 Waddamana B

Description Part of an annex constructed to the north east of the Turbine Hall. The annex is divided into three rooms. This room is the Waddamana B workshop. There is a standard gauge tramway from the turbine Hall into the workshop. The 1949 plan shows benches for lathes and other tools. The workshop is 22" wide (13.51m) and 40.5" (12.34m

Historical Summary There is an chain driven travelling crane over the tramway and a welding bay which may be more recent additions.

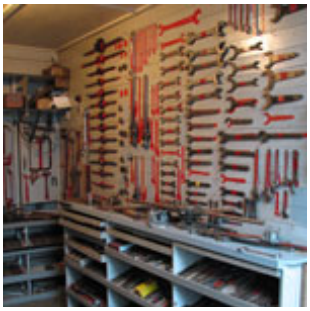
Comments Still in use.

Condition Good

Significance High

BH58

Name Tool Store
Precinct Precinct 3 Waddamana B
Description The tool is a small room off the main workshop. It is notable for the shadow boards and tools in situ.
Historical Summary
Comments This is an amazing old store.
Condition Good
Significance Very High



BH59

Name Store
Precinct Precinct 3 Waddamana B
Description This store is still in use by Transend.
Historical Summary
Comments Not accessible
Condition Not known
Significance Medium

BH60

Name Waddamana B Switch yard
Precinct Precinct 3 Waddamana B
Description The Switch Yard for Waddamana B was located to the south west of the Turbine Hall however the Switch Yard has been demolished leaving only the concrete footings.
Historical Summary
Comments
Condition Poor
Significance Medium

BH61

Name Tailrace
Precinct Precinct 3 Waddamana B
Description The tailrace to Waddamana B runs parallel to the Turbine Hall and then curves to the west to discharge into the Ouse River.
Historical Summary
Comments
Condition Good
Significance High

BH62

Name Entrance to Waddamana A

Precinct Precinct 2 Waddamana A

Description As part of the 1922 construction works an elaborate entrance to the Power Station was constructed. As part of the construction work the previous building that housed the transformers was rebuilt as a two story annex. The entrance to the annex which became the main entrance to Waddamana A was up two flights of stairs.
The façade of the annex, the south eastern face of the annex, was decorated in a pseudo-classical style using concrete to create a parapeted gable. While there are obvious classical motifs the effect is somewhat diminished by the use of galvanised iron to fill the spaces between the columns and windows.
At ground level a series of square bollards define the road to the entrance. A recent planting of four Cyprus's was not part of the original design.

Historical Summary The construction of an elaborate entry to Waddamana fits in with the Hydro Electric Department's elaborate opening ceremonies and the fit out of the annex.

Comments

Condition Good

Significance Very High

BH63

Name Workshop area

Precinct Precinct 4 Outside Workshop

Description The area to the north west of Waddamana B was used for maintained stores, used I think to maintain the penstocks. Currently this area is clearly and artificially flattened and partly built up area with foundations of the buildings shown on the 1949 plan

Historical Summary This area has been used for a series of buildings over time but it seems likely that the final use of the area as workshops would have disturbed or destroyed archaeological evidence of the previous use of the area.

Comments The edge of this area has been used as a tip and is likely to have all manner of rubbish.

Condition Good (as ruins)

Significance Low

BH64

Name Transmission Lines

Precinct Precinct 5 Transmission Lines

Description The Transmission Towers that took the power lines away from Waddamana A switch yard have been removed, however evidence of their location is found in the form of stone platforms forming the base of the towers.

Historical Summary

Comments

Condition Good (as ruins)

Significance Medium

BH65

Name Row of Pine Trees

Precinct Precinct 5 Transmission Lines

Description A row of "Blue spruce" pines runs along north eastern side of the road to the Power Station. Eight trees in all within the study area (others exist outside the study area)

Historical Summary These were planted post -1950.

Comments

Condition Good

Significance Low

BH66

Name Quarry site

Precinct Precinct 6 Bush

Description Frank Cooper identified that the only item in this precinct relating to the Power Stations was a small quarry which has a fossil deposit in it.

Historical Summary May have been a source of raw material for construction of the Power Stations.

Comments Not Inspected

Condition Not known

Significance Neutral

BH67

Name Electrolytic Lightening arrestor
Precinct Precinct 5 Transmission Lines
Description Electrolytic Lightening arrestor
Historical Summary Probably erected in the early 1920s
Comments
Condition Good
Significance High

BH68

Name Room over workshop
Precinct Precinct 3 Waddamana B
Description Room over workshop (BH 54).
Historical Summary
Comments Full of junk
Condition Good
Significance Medium

BH69

Name Light poles
Precinct Precinct 5 Transmission Lines
Description Electric Light Poles, constructed using a single vertical rail with a sheet metal curved section and shade.
Historical Summary
Comments There are a total of four poles
Condition Good
Significance High

Appendix B

Movable Heritage Audit

WADDAMANA
POWER STATION
APPENDIX B: MOVABLE HERITAGE AUDIT

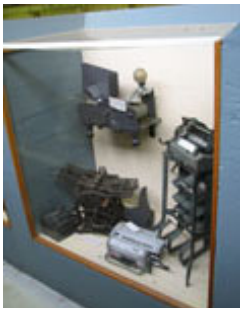
Godden Mackay Logan
Heritage Consultants

MH01

Description	Electric Stoves
Material Type	Metal, Bakelite, enamel
Number of items	6
Condition/completness	Complete
Location	Switch Galley, Waddamana A
Theme	History of Hydro Electricity
Significance	Contributory

MH02

Description	Electric Office Machines
Material Type	Metal
Number of items	5
Condition/completness	Complete
Location	Display Case Switch Galley, Waddamana A
Theme	History of Hydro Electricity
Significance	Contributory

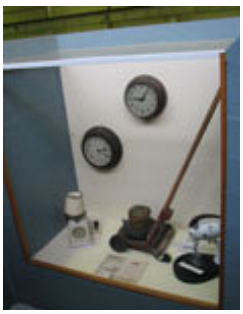


MH03

Description	Electric Irons and Radio
Material Type	Metal & Wood
Number of items	5
Condition/completness	Complete
Location	Display Case Switch Galley, Waddamana A
Theme	History of Hydro Electricity
Significance	Contributory

MH04

Description	Electric clocks, coffee maker, Mix Master, Electric mower & instruction book
Material Type	Metal, wood, Plastic and Paper
Number of items	7
Condition/completness	Complete
Location	Display Case Switch Galley, Waddamana A
Theme	History of Hydro Electricity
Significance	Contributory



MH05

Description Electric heaters, copper, stove & fan
Material Type Metal
Number of items 17
Condition/completness Complete
Location Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH06

Description Various electrical testing meters and instruction book
Material Type Metal and Wood
Number of items 9
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH07

Description Various electrical testing meters and instruction book
Material Type Metal
Number of items 7
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH08

Description Electric meters
Material Type Metal
Number of items 7
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH09

Description Electric relays
Material Type Metal and Plastic
Number of items 7
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH10

Description Electric meters
Material Type Metal
Number of items 15
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH11

Description Electrical meters
Material Type Metal
Number of items 21
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH12

Description Electric meters and light globes
Material Type Metal and Glass
Number of items 44
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH13

Description Electric meters and light globes
Material Type Metal and Glass
Number of items 35
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH14

Description Electric meters
Material Type Metal
Number of items 9
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH15

Description Galvanometers
Material Type Metal and Wood
Number of items 8
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH16

Description Electric kettle, heater, sandwich maker fuses
Material Type Metal
Number of items 6
Condition/completness Complete
Location Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH17

Description Electric calculators, fuse
Material Type Metal
Number of items 5
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH18

Description Volt meters
Material Type Metal
Number of items 12
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH19

Description Volt meters
Material Type Metal
Number of items 12
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH20

Description Recording meter
Material Type Metal and Papers
Number of items 6
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH21

Description Time switches
Material Type Metal
Number of items 8
Condition/completness Complete
Location Display Case Switch Galley, Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH22

Description 300KVA Generator set
Material Type Metal
Number of items 1
Condition/completness Complete
Location Bottom of stairs, NE corner
Theme Waddamana Power Stations
Significance Significant

MH23

Description Mobile fire hose reels
Material Type Metal and canvas
Number of items 2
Condition/completness Complete
Location Bottom of stairs, NE corner
Theme Waddamana Power Stations
Significance Contributory

MH24

Description Electric steam generator
Material Type Metal
Number of items 1
Condition/completness Missing gauges
Location Bottom of stairs, NE corner
Theme History of Hydro Electricity
Significance Contributory

MH25

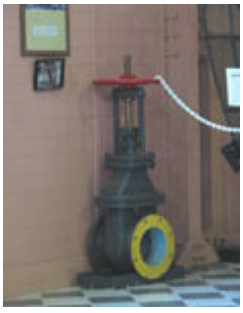
Description	Vortex turbine and generator set and governor (ex Duck Reach)
Material Type	Metal
Number of items	3
Condition/completness	Missing some bits and pieces
Location	North east corner
Theme	History of Hydro Electricity
Significance	Significant

MH26

Description	Vale on penstock (ex Duck reach)
Material Type	Metal
Number of items	1
Condition/completness	Complete
Location	North east wall
Theme	History of Hydro Electricity
Significance	Significant

MH27

Description	Small valve (ex Duck Reach)
Material Type	Metal
Number of items	1
Condition/completness	Complete lacks context
Location	North east wall
Theme	History of Hydro Electricity
Significance	Contributory



MH28

Description	Untitled Sculpture (by James Vaughn)
Material Type	Metal and Bakelite
Number of items	1
Condition/completness	Complete
Location	East corner
Theme	History of Hydro Electricity
Significance	Significant

MH29

Description	Air compressor
Material Type	Metal
Number of items	1
Condition/completness	Complete
Location	South east wall
Theme	History of Hydro Electricity
Significance	Significant

MH30

Description	Reflecting Dynamometer, used for precise testing and calibration of current measuring instruments. Dates from 1937.
Material Type	Metal and Wood
Number of items	1
Condition/completness	Complete?
Location	North East wall
Theme	History of Hydro Electricity
Significance	Contributory

MH31

Description	Survey display of surveying instruments and diorama
Material Type	Metal, wood and plastic
Number of items	20
Condition/completness	Complete
Location	North corner
Theme	History of Hydro Electricity
Significance	Significant

MH32

Description	Metal impeller
Material Type	Metal
Number of items	1
Condition/completness	Complete
Location	North west wall
Theme	History of Hydro Electricity
Significance	Contributory

MH33

Description	Display of transmission wire
Material Type	Metal and wood
Number of items	2
Condition/completness	Complete
Location	North west wall
Theme	History of Hydro Electricity
Significance	Contributory

MH34

Description	Transformer Display
Material Type	Metal
Number of items	7
Condition/completness	Complete
Location	North west wall
Theme	History of Hydro Electricity
Significance	Contributory

MH35

Description	Sign
Material Type	Metal
Number of items	1
Condition/completness	Complete
Location	North west wall
Theme	History of Hydro Electricity
Significance	Contributory

MH36

Description Table with AC meter display
Material Type Metal and wood
Number of items 9
Condition/completness Complete
Location North West Wall
Theme History of Hydro Electricity
Significance Contributory

MH37

Description Battery display
Material Type Metal, ceramic, plastic
Number of items 6
Condition/completness complete
Location North West Wall
Theme History of Hydro Electricity
Significance Contributory

MH38

Description Pumps in various states of repair (ex Lake Echo?)
Material Type Metal
Number of items 10
Condition/completness Disassembled
Location West corner Waddamana B
Theme History of Hydro Electricity
Significance Contributory

MH39

Description Small Transformers
Material Type Metal , plastic Ceramic
Number of items 1
Condition/completness Complete
Location West corner Waddamana B
Theme History of Hydro Electricity
Significance Contributory

MH40

Description Miscellaneous including a large anti vacuum valve
Material Type Metal
Number of items 10
Condition/completness Complete
Location West corner Waddamana B
Theme History of Hydro Electricity
Significance Contributory

MH41

Description Petrol Pump from Underground Storage Tank at Waddamana B
Material Type Metal and Rubber
Number of items 1
Condition/completness Complete
Location North East Wall, Waddamana B
Theme Waddamana Power Stations
Significance Contributory

MH42

Description Collection of various electric pumps and motors
Material Type Metal and rubber
Number of items 9
Condition/completness Complete
Location North East Wall, Waddamana B
Theme History of Hydro Electricity
Significance Contributory

MH43

Description Miscellaneous wrenches, winches spanners
Material Type Metal
Number of items 10
Condition/completness Complete
Location North East Wall, Waddamana B
Theme Waddamana Power Stations
Significance Contributory

MH44

Description Portable hose reel
Material Type Metal and canvas
Number of items 1
Condition/completness Complete
Location South West Wall
Theme History of Hydro Electricity
Significance Contributory

MH45

Description Rectifier
Material Type Metal
Number of items 1
Condition/completness Complete
Location North East Wall, Waddamana B
Theme History of Hydro Electricity
Significance Contributory

MH46

Description Electrical Powered oil separator
Material Type Metal
Number of items 1
Condition/completness Complete
Location North West Wall Waddamana A
Theme Waddamana Power Stations
Significance Contributory

MH47

Description Electrical powered Sharpes Super Centrifuge
Material Type Metal
Number of items 1
Condition/completness Complete
Location North West Wall Waddamana A
Theme Waddamana Power Stations
Significance Contributory

MH48

Description Set of spanners to serve machines
Material Type Metal
Number of items 8
Condition/completness Complete
Location North West Wall Waddamana A
Theme Waddamana Power Stations
Significance Significant

MH49

Description Oil Testing display
Material Type Metal leather plastic
Number of items 1
Condition/completness Complete
Location North West Wall Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH50

Description Pipe display (unique for displaying asbestos)
Material Type PVC, Metal, iron, steel, asbestos
Number of items 1
Condition/completness Complete
Location North West Wall Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH51

Description Section of Wood stave Pipe
Material Type Wood and metal
Number of items 3
Condition/completness Complete
Location North West Wall Waddamana A
Theme The Great Lakes Scheme
Significance Contributory

MH52

Description Nozzle, spear and bucket from Pelton wheel
Material Type Meta
Number of items 3
Condition/completness Complete
Location North West Wall Waddamana A
Theme Waddamana Power Stations
Significance Contributory

MH53

Description Memorial Plaques
Material Type Stone and Metal
Number of items 3
Condition/completness Complete
Location Western corner Waddamana B
Theme The Great Lakes Scheme
Significance Significant

MH54

Description Control board Shannon Power Station
Material Type Metal and Bakelite
Number of items 1
Condition/completness Complete
Location South West Wall Waddamana A
Theme The Great Lakes Scheme
Significance Significant

MH55

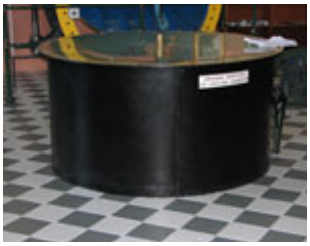
Description Steel Axel
Material Type Metal
Number of items 1
Condition/completness Complete
Location South West Wall Waddamana A
Theme Waddamana Power Stations
Significance Contributory

MH56

Description Section of Penstock
Material Type Metal
Number of items 1
Condition/completness Complete
Location South West Wall Waddamana A
Theme The Great Lakes Scheme
Significance Contributory

MH57

Description Original Penstock
Material Type Metal
Number of items 1
Condition/completness Complete
Location Near stairs Waddamana A
Theme The Great Lakes Scheme
Significance Contributory



MH58

Description Lap winding
Material Type Metal
Number of items 1
Condition/completness Complete
Location Near stairs Waddamana A
Theme Waddamana Power Stations
Significance Contributory

MH59

Description Display of insulting
Material Type Metal
Number of items 20
Condition/completness Complete
Location Near stairs Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH60

Description Shannon valve
Material Type Metal
Number of items 1
Condition/completness Complete
Location Near stairs Waddamana A
Theme The Great Lakes Scheme
Significance Significant

MH61

Description Transformer Display
Material Type Metal
Number of items 1
Condition/completness Complete
Location South East wall Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH62

Description Pump display
Material Type Metal
Number of items 7
Condition/completness Complete
Location Workshop Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH63

Description Oil Filled Circuit Breaker
Material Type Metal
Number of items 1
Condition/completness Complete
Location Entrance to Workshop area Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH64

Description Piston pump
Material Type Metal
Number of items 1
Condition/completness Complete
Location Workshop Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH65

Description Jack Hammer display
Material Type Metal
Number of items 1
Condition/completness Complete
Location Workshop Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH66

Description Operating sticks
Material Type Wood and metal
Number of items 9
Condition/completness Complete
Location Workshop Waddamana A
Theme History of Hydro Electricity
Significance Contributory

MH67

Description Earthing Trolley
Material Type Wood and metal
Number of items 1
Condition/completness Complete
Location Switchyard Waddamana A
Theme The Great Lakes Scheme
Significance Contributory

MH68

Description Horse Drawn excavator
Material Type Wood and metal
Number of items 1
Condition/completness Complete
Location Switchyard Waddamana A
Theme The Great Lakes Scheme
Significance Contributory

MH69

Description Concrete Barrow
Material Type Metal
Number of items 1
Condition/completness Complete
Location Switchyard Waddamana A
Theme The Great Lakes Scheme
Significance Contributory

MH70

Description Tramway wheels and pipe
Material Type wood and Metal
Number of items 1
Condition/completness Complete
Location Switchyard Waddamana A
Theme The Great Lakes Scheme
Significance Contributory

MH71

Description Jinker- wooden hubs and wheels
Material Type Wood metal
Number of items 1
Condition/completness Complete
Location Switchyard Waddamana A
Theme The Great Lakes Scheme
Significance Contributory

MH72

Description Winch
Material Type Metal
Number of items 1
Condition/completness Complete
Location Switchyard Waddamana A
Theme The Great Lakes Scheme
Significance Contributory

MH73

Description Jinker metal wheels no springs
Material Type Metal
Number of items 1
Condition/completness Complete
Location Switchyard Waddamana A
Theme The Great Lakes Scheme
Significance Contributory

MH74

Description Radial Gate installed below Shannon
Material Type Wood and Metal
Number of items 1
Condition/completness Complete
Location Switchyard Waddamana A
Theme The Great Lakes Scheme
Significance Contributory

MH75

Description Air Pump
Material Type Metal
Number of items 2
Condition/completness Partially complete
Location Western corner Waddamana A
Theme The Great Lakes Scheme
Significance Contributory

MH76

Description	Air compressor
Material Type	Metal
Number of items	1
Condition/completness	Complete
Location	Workshop Waddamana A
Theme	History of Hydro Electricity
Significance	Contributory