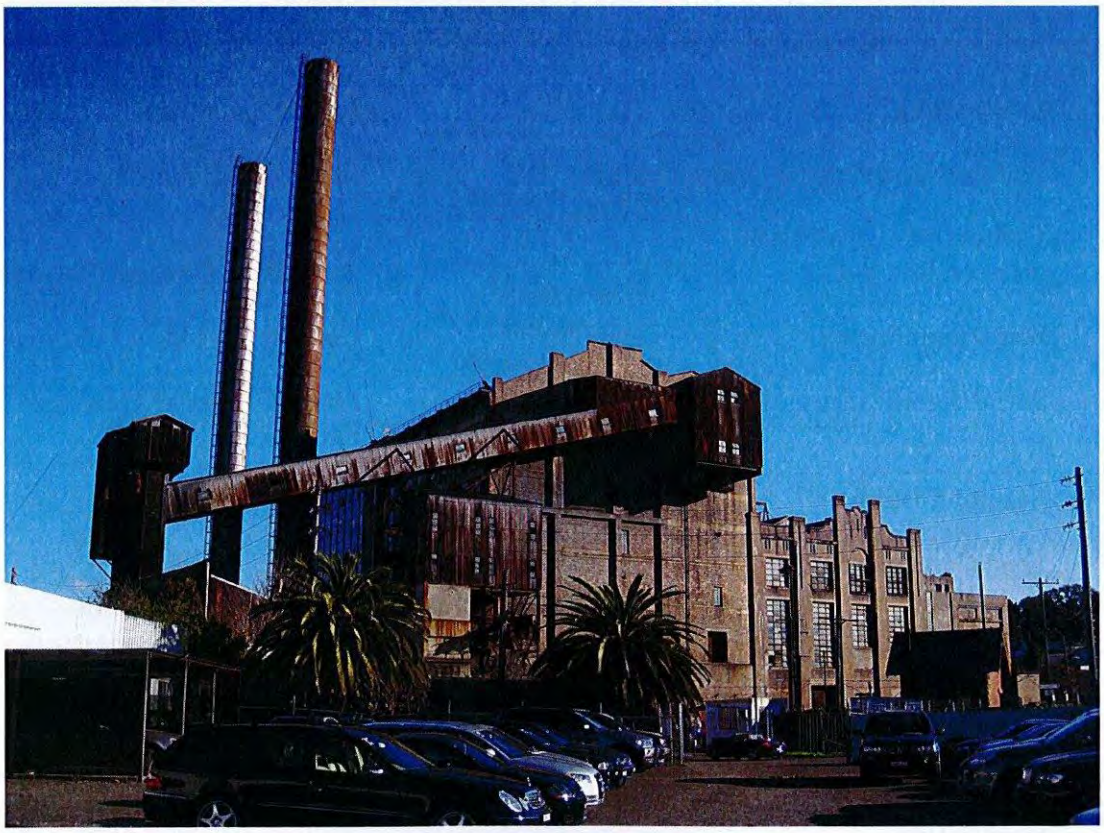
WHITE BAY POWER STATION

Robert Street, ROZELLE, NSW 2039

CONSERVATION MANAGEMENT PLAN
VOLUME IV
STRUCTURAL CONDITION ASSESSMENT
(& Maintenance Schedule)



prepared for
The Sydney Harbour Foreshore Authority

by a team led by

Design 5 Architects Pty Ltd
5 Queen Street, Chippendale, NSW 2008
Phone: (02) 9319 1855

FINAL REPORT
SECOND EDITION JULY 2011
(Revised March 2013)

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Cover Image: White Bay Power Station from Robert Street, July 2010 (Design 5 - Architects)

This report has been produced at Design 5 – Architects and is the compilation of work by the following team:

First Edition

Lead Consultant	Design 5 Architects
Primary areas of input:	
Conservation planning co-ordination, conservation analysis, conservation policy and maintenance	Design 5 Architects
Industrial and machinery heritage	Godden Mackay Logan
Engineering	Hughes Trueman
Planning and statutory considerations	JBA Urban Planning
Conservation analysis & conservation policy	Anne Warr Heritage Consultant
Social Significance	Context Pty Ltd
Social Significance and History	Meredith Walker Heritage Futures

Second Edition

Lead Consultant	Design 5 Architects
Primary areas of input:	
Conservation planning co-ordination, conservation analysis, conservation policy and maintenance	Design 5 Architects
Engineering	Hughes Trueman Mott Macdonald
Client body and review	Sydney Harbour Foreshore Authority

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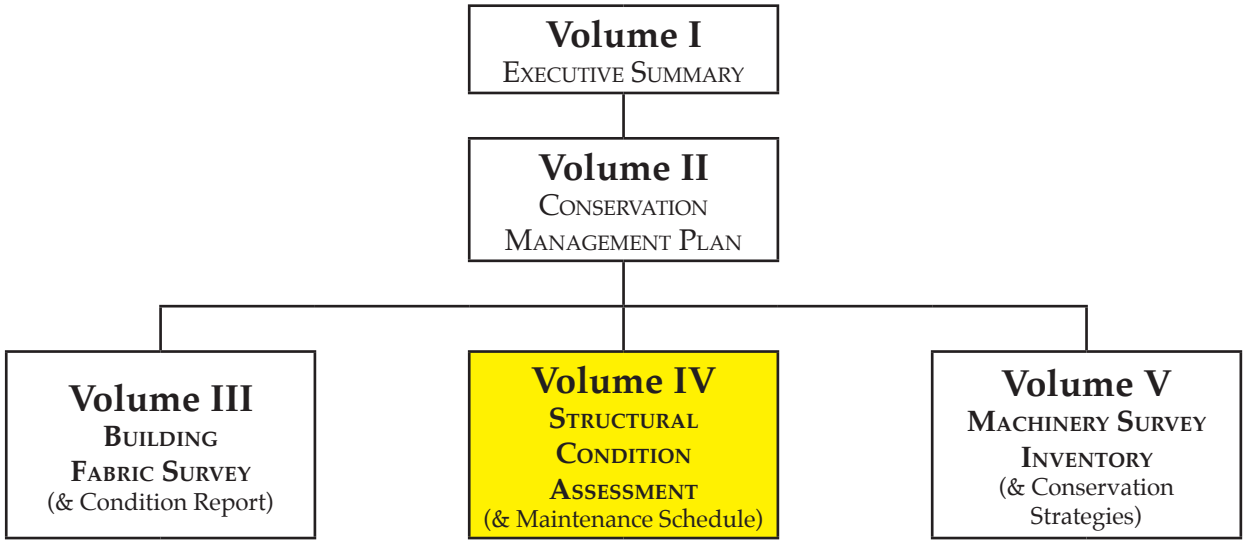
Structure of the Report

The White Bay Power Station Conservation Management Plan is arranged in Five Volumes in a hierarchy as demonstrated by the following diagram. The results of the investigations of the building fabric survey, structural condition assessment and machinery survey inventory and conservation strategy are contained in three Volumes (III - V).

The information in these three Volumes is summarised in Volume II and informs the Assessment of Cultural (Heritage) Significance and the Management Policies which result from these Assessments.

Volume I is the Executive Summary which gives a broad overview of the whole report and summarises the most important Policies for the conservation of the White Bay Power Station.

No strategies should be devised nor any work carried out relying solely on the information contained in Volume I. Reference must be made firstly to Volume II and then the volume containing the relevant detail. That reference should also be noted against any such strategy or work instruction.



This is Volume IV

The following table shows each volume that has been amended/revised as part of each issue. Some volumes may not have been amended but are identified on the cover as belonging to an amended set.

CMP amendment date (issue):	Volumes amended as part of an amendment set					
	Volume I	Volume II	Volume III	Volume IV	Volume V	Appendices
January 2004 *Original Report*	✓	✓	✓	✓	✓	✓
Second Edition July 2011 *Revision and update*	✓	✓	✓	✓		
Second Edition July 2011 (Revised March 2013) *Minor amendments*	✓	✓				✓

Summary Contents of whole report

VOLUME V
MACHINERY SURVEY INVENTORY & CONSERVATION SCHEDULES

Introduction

Contextual History

Description of Fabric

Significance Assessment

Constraints & Opportunities

APPENDICES

A The Burra Charter 1999

B Heritage Listings

C Bibliography & References

D Supplementary Illustrations

E Social Significance Report - Context Pty Ltd - November 2002

F Standard Exemptions under the Heritage Act 1977 (NSW)

G Report: The Significance of White Bay and Balmain Power Stations to Sydney's Industrial Heritage, a report to the Electricity Commission of NSW (Don Godden and Associates & Heritage Consultants, 1989)

STRUCTURAL CONDITION ASSESSMENT

SYDNEY HARBOUR FORESHORE AUTHORITY

WHITE BAY POWER STATION

JULY 2011

HUGHES TRUEMAN

PREPARED BY

ALEX BEEN AND FELICITY SMITH

REVIEWED BY

SIMON WILTSHIER

JOB NO: 10S095

TABLE OF CONTENTS

1.0 INTRODUCTION

Hughes Trueman have prepared this report in response to a request by the Sydney Harbour Foreshore Authority (SHFA) to produce an update of the schedule of works that was prepared by Hughes Trueman in 2003 for inclusion in the Conservation Management Plan of the White Bay Power Station. This plan assesses the current condition of the buildings and structural supports to plant and equipment on site and outlines recommended measures to maintain the condition of the relevant heritage assets within the bounds of the site. The report identifies repairs necessary to restore the relevant fabric to a satisfactory standard.

Hughes Trueman is working with a team of consultants, lead by Design 5 Architects, to develop a range of options and determine the constraints related to the adaptive reuse of the power station.

At the time of preparing this report, the power station was out of use.

1.1 REFERENCE DOCUMENTS

During the course of the development of this report, the following documents were referred to:

- *White Bay Power Station Chimney Stacks, Coal Plant and Ash Plant Structures – Condition Assessment* – Pacific Power – March 1995
- *White Bay Power Station Asset Management Plan* – Pacific Power – May 1995
- *White Bay Power Station – A Study of Preservation Works Necessary to Retain the Heritage Fabric* – Pacific Power – October 1994
- *The Significance of White Bay and Balmain Power Stations to Sydney's Industrial Heritage* – Don Godden and Associates and Heritage Consultants – 1989
- *White Bay Power Station Heritage Study* – Heritage Group State Projects DPWS – July 1994
- *Minimum Standards of Maintenance and Repair* – NSW Heritage Office
- *Specification for Structural Remedial Works* – ACOR Consultants – September 2007
- *Structural Condition Assessment Report* – Hughes Trueman – 2003

1.2 HOW TO USE THIS DOCUMENT

Section 2 identifies and categorises generic issues that occur in various locations throughout the site.

Section 3 is a schedule of repair and maintenance for specific types of problem. It approximately identifies location and is sub-divided into sections being General (ie. across the site in several locations), Boiler House, Coal Loader and Conveyor, Exterior, Turbine House & Administration Building and Switch House & Control Room. Each location is divided into the findings of the 2003 report, and the recent updates.

Section 3 references particular repair specifications which are found in Section 4 and maintenance and monitoring period recommendations which are explained in section 5.

Section 6 outlines further specialist investigations that will be required associated with adaptive re-use.

Section 7 provides comment on items which may be of heritage significance from a structural engineering viewpoint.

Section 8 outlines materials replacement policy

The Appendices A, B and C contain photographic data, site maps and room number schedules respectively which are cross-referenced with the schedule in Section 3.

2.0 STRUCTURAL CONDITION ISSUES

2.1 OVERVIEW

The power station was originally designed for industrial use with facility to handle and store large quantities of coal and safely and reliably reticulate water, steam and electricity.

Consequently construction is robust and many components could be expected to have extensive reserve capacity for adaptive re-use.

In addition the facility is likely to have been well built and maintained. Consequently the majority of deterioration noted probably relates to the last twenty years or so since closure.

Much of the damage evident results from the ingress of water from the failed windows or roofs or from the blocked or failed stormwater or drainage, as well as the lack of regular maintenance. Site security is also an issue and much of the glass breakage has been due to vandalism.

The load capacity of all floors should be assessed for specific future use proposals. There have been significantly deterioration in some area of timber flooring due to the ingress of water and termites. Such areas include the floor to the inclined conveyor shaft from the coal loader to the boiler and the upper floor of the administration building.

Loss of cross sectional area and section strength of the columns is locally evident at some base connection due to excessive corrosion. This is significant to the Boiler House and Coal Loader. There is much evidence of corrosion to steel connection, roof , wall cladding, steel reinforcement in some concrete elements, and steel grate flooring. In addition, there are large underground areas which retain both structure and machinery but are now filler with water and suffering corrosion.

Guy ropes for the two chimneys should be immediately investigated to determine if repairs are required. The chimneys themselves could not be inspected as part of this report, and require a specialised assessment with special access equipment.

Due to the replication of many items and types of defect in the power station, this report identifies both generic structural condition issues and specific issues. This section identifies and categorises the generic issues that occur throughout the site.

2.2 STRUCTURAL STRENGTH DEFICIENCY

2.2.1 Steel Columns

Loss of cross-sectional area and section strength of steel columns is locally evident at some base connections due to excessive corrosion. This is especially significant in the Boiler House, Turbine House and Coal Loader. A number of the worst effected columns have recently been repaired with replacement of corroded material and coated with a protective paint system.

2.2.2 Concrete Slabs

The mezzanine slab in the Boiler House has holes punched in it, which may be the result of heavy impacts probably during removal of equipment. These voids have not only reduced the slab strength but also are a serious safety hazard.

Generally, due to the original design loads anticipated for the structure, concrete slabs would be expected to have sufficient capacity to withstand most future use options. Load capacity checks are not however within the scope of this report.

Several areas of slabs in the Turbine House have lost concrete cover to the bottom layer of reinforcement due to reinforcement corrosion. While the slabs are currently robust, ongoing deterioration will eventually lead to loss of strength or failure.

2.2.3 Guy Ropes and Shock System for Chimneys

Guy rope anchors from the chimneys to the Boiler House roof slab need detailed investigation immediately as the concrete in the vicinity of the anchors has badly cracked. The significance of this cracking is not known, however the consequences of failure may be serious. Elsewhere on site the anchors are vulnerable to vandalism and general wear. Whether the damping system is still operable is unknown.

2.2.4 Steel Window Frames

Windows on the North-West wall of the Boiler House have lost significant mullion strength due to corrosion. To temporarily increase strength, vertical mullions have been tied with timber members. Excessive corrosion of steel window frames is a general problem throughout the Boiler House, Coal Loader, Turbine House, Switch House and Administration Building.

2.2.5 Floor Grates

In localised areas in the Boiler House, floor grates have deflected excessively and have reduced bearing area onto the supporting beams. Steel beams supporting these floor grates appear currently to be structurally adequate but exhibit significant surface corrosion. Some of the grates themselves may have compromised structural integrity due to exposure and prolonged corrosion.

2.2.6 Water Tank

The water tank attached to the inside face of the southern parapet of the turbine house above roof level has developed excessively wide cracks and is severely affected by spalling. This requires immediate attention, as the condition of the tank has significantly reduced its structural capacity and there is the danger of collapsing material affecting the area around and below it.

2.3 CORROSION

2.3.1 Roof Beams and Columns

Corrosion of steel beams and columns is one of the critical issues. Due to a number of reasons including water ingress, exposure to weather and lack of maintenance, over 90% of the structural steelwork is affected by corrosion. Around 25% of the steelwork has lost sufficient cross-sectional area to affect strength. For example, first floor beams on the North-East side of Turbine House have lost significant section in the compression flange and the beams and columns supporting the first floor concrete slab on the east side of Boiler House have been similarly affected. The beams supporting the southern half of the Boiler House roof are severely corroded. Although surface corrosion is extensive, it is unlikely that a significant amount of steelwork will require replacement after treatment in accordance with this report (VolumeIV)

2.3.2 Corrugated Metal Roof

Corrugated metal roofs of the Boiler House, Coal Loader, Conveyor Building and Turbine House are severely damaged due to corrosion and failure of fixings. Over the years penetrations have formed within the roof that are impacting on the overall corrosion problem to the supporting structure below by allowing rainwater ingress.

2.3.5 Chimneys

Base plate and anchor bolts at the base of chimneys are affected by rust. These need to be treated for corrosion with ongoing painting maintenance in the future. We understand from site staff that some connections of the access ladders to the stacks may have failed. This is a significant issue since it may severely restrict access for inspection, maintenance and repairs.

Access to the stacks is outside Hughes Trueman's area of expertise and we refer to the Chimney Stacks Condition Assessment of 1995 referred to in Section 1.1.

The inspection by Hughes Trueman did not include the interior or exterior of the stacks which would require specialised access equipment and should be carried out by a specialist. we however included general observations in the schedules.

2.4 CRACKING

2.4.1 Concrete Beams and Slabs

Steel beam-column frames are used throughout the power station except the Switch House, where reinforced beams and columns are used and are an addition at a later stage. A severe cracking problem is evident in the Switch House, especially at the east and west ends of the third floor in the beams and the walls.

The reinforced concrete frame and wall structure of the 1927 work is showing signs of corrosion at sill to windows and around frames, particularly at the south end of the Administration building.

2.4.2 Masonry Walls

Cracking of masonry walls occurs in various locations around the site. In the Boiler House, the main reason for cracking of masonry walls is the corrosion of the steel beams that are bearing into the east and west walls at mid height. Extensive accumulation of rust on these beams has caused cracking. However, cracking of the Switch and Turbine Houses appears mainly to be due to temperature and moisture effects. Cracking is evident on the south wall of the Boiler House where the cracks are ranging up to 25mm in width. Cracking at other places includes the east wall of Turbine House and in the parapet on the north exterior face of the Turbine House.

2.5 WATER PROOFING

2.5.1 Galvanised Steel Sheet Roof and Walls

The galvanised steel roofs and walls need extensive treatment or replacement throughout the site especially the roof of the Turbine House and the walls of the Elevator Tower. Roof repair is an important and urgent issue that requires early attention. Rainwater ingress is making the corrosion problem worse and in addition to this, wind has the potential to lift off rusted wall panels from the Elevator Tower. This is not only causing damage to the structure and equipment but is also a safety hazard. Wall panels are heavily rusted and/or missing in the Elevator Tower of the Coal Loader. An opening in the north wall of Coal Loader, which used to be an entrance to the building, needs to be covered by sheeting. The roof of Turbine House is affected badly by corrosion and leakage. Missing roof panels are causing ingress of rainwater and allowing access to pigeons.

2.5.2 Stormwater

Leakage of stormwater pipes is an important issue in the Pump House and the Administration Building. Due to the continuous leakage and build up of water, the timber floor on the third level of Administration Building which overlies a concrete slab has suffered extensive decay and much of it has collapsed. The box gutter over this area has failed completely and now directs roof water into the structure. Stell beams and column in these areas are also severly rusted. Their constant saturation is leading to corrosion and if left unchecked and untreated will lead to failure.

2.5.3 Unglazed Windows

Unglazed windows are allowing water and pigeons into the building. Other than this, they are also a safety hazard as the left over sections of broken glass can fall off in windy conditions.

Until the building is put to new use the use of perspex panels (as is currently the case) to replace glass is a sensible precaution. Vandalism appears to be a primary cause of glass breakage.

2.5.4 Underground Areas

There are large underground areas which still retain both structure and machinery and now filled with water. These areas should be permanently drained and all structures, machinery and fabric conserved and repaired.

2.6 CONCRETE SPALLING

Spalling is another critical issue. Spalling of the concrete slabs needs urgent attention to arrest ongoing deterioration of the reinforcement and slabs due to the corrosion. On the east side of the Turbine House under the Pump Room, the underside of the first floor slab is severely affected by spalling. Reinforcement is exposed and is badly corroded. The precast roof panels of the southern section of the Boiler House are critically damaged due to spalling. Water is penetrating the roof membrane and also the precast panels. It is likely that the panels have insufficient cover for exposure to water. The spalling is highly dangerous as lumps of concrete can fall a great distance at high velocity to the boiler room floor. The area of ground floor directly beneath the affected panel has been generally fenced off, however that spalling has not been addressed.

2.7 SAFETY HAZARDS

2.7.1 Floor Gratings

Floor grating is an important issue in the Boiler House, Coal Loader and the Turbine House.The covers on several pits around the site have severe corrosion and all gratings should be considered suspect. Steel floor gratings in the Boiler House have significantly lost strength at support edges due to corrosion. Areas of floor grates are missing in the Turbine House.

2.7.2 Timber Floors and Walkways

Timber is severely affected by leakage of stormwater pipes, missing stormwater pipes, ingress of rainwater through the roof and windows, and termites. Timber walkways on the second level of the Turbine House are decayed or damaged and need to be removed and replaced.

The timber floor on the third level of the Administration Building which appears to overlay a concrete slab is severely damaged by water and termites, which has resulted in the formation of voids in the floor

The timber floor of the Conveyor Area is severely affected by termites. Entry to this area should continue to be barred by physical barricades and signage.

2.7.3 Handrails

The condition of handrails is a safety issue in the Boiler and Turbine Houses. Missing and/or broken handrails occur on the upper floors of both buildings. These require immediate repair or replacement.

Handrails which may have been suitable for the use of the facility by trained adult staff are now inadequate for general public access. Handrails complying with current BCA standards are now required.

2.7.4 Open Pits

The Coal Loader and Turbine House are affected badly by this problem. Deep pits, some of which are full of water, need to be covered or fenced off with appropriate handrails. Some pits have temporary barricades and covers, however a long-term solution should be developed for the protection of these areas.

2.7.5 Trip Hazards

Trip hazards are an issue throughout the power station. Uneven floors, uncovered openings in the slabs due to the removal of equipment, absence of floor grates and debris on floors and walkways are contributing to this issue. In addition, floor tiles on the southern part of the second floor of Switch House are causing a trip hazard.

2.7.6 Headroom Clearance and Projecting Objects

Consideration of headroom clearance and projecting objects is important throughout the site but particularly in the Elevator Tower and on the upper levels of the Turbine House. In the Elevator Tower stairs are narrow and pipes project from the adjacent equipment.

Headroom clearance should be surveyed along all trafficable routes and projecting items should, as appropriate, either be removed or be padded and marked.

2.7.7 Unsecured Materials and Items

Unsecured material and equipment needs attention. There are shackles and pulleys supported by unmaintained rope and wire slings at various locations.

2.7.8 Site Security and Vandalism

Site security will be an ongoing issue. Multiple access points to the buildings, unglazed windows and unfenced areas are all factors. For example, foundations for the guy rope anchors of the chimneys on the east-side are located outside the fence and are vulnerable to vandalism. Until the site is occupied, security remains an important issue.

Since 2004 to present, these have been several instances of vandalism and attempted theft inside the Administration Building, Switch House and the Control Room. The buildings are particularly vulnerable at ground level and along the southern edges. Perimeter and internal security have been strengthened, how ever these should be further enhanced to protect this unique and exceptionally significant asset/ property.

2.8 GENERAL WORK

2.8.1 Waste Removal

General cleaning and waste removal is required. Presence of debris on the stairs of the Coal Loader and the floors of the Turbine House and the Boiler House is a safety hazard. In addition to this, concrete is piles up on the ground on the east side of the turbine House and needs to be removed because of it is a potential safety hazard.

2.8.2 Vegetation

Vegetation growth throughout the site needs to be controlled.

2.8.3 Floor Tiles

Floor tiles on the south side of second floor of the Switch House are coming off and causing a trip hazard. They need to be removed or repaired.

3.0 REPAIR AND MAINTENANCE SCHEDULE

(Refer Section 5.0 for explanation of Risk Assessment)

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
GENERAL ITEMS – The following items apply throughout the site. No particular map reference is provided										
1	-	Throughout the site	Window Frames and glazing	Loss of strength and cross-sectional area of window frames due to excessive corrosion is a general problem throughout the Boiler House, Coal Loader, Turbine House, Switch House and Administration Building. In addition to the weak frames, approximately 90% of these windows are either unglazed or with broken glazing which is allowing pigeon and water ingress.	4.25	1 year	10 years	3	3	2
2	-	Throughout the site	Structural Connections	Structural connections throughout Boiler House, Coal Loader and Turbine House are extensively rusted and need treatment. Inspection has shown rusting of bolts as well and this could result in loss of strength of the connection in the future, if not treated now.	4.15, 4.16	1 year	10 years	3	3	2
3	-	Throughout the site	Site Security and Vandalism	Site security is a general issue throughout the site. Multiple access points to the buildings, unglazed windows and unfenced items are problems. For example, foundations for guy rope anchors on the east are located outside the fence and are vulnerable to vandalism. Until the site remains occupied, security will be an important issue.	2.7.8	Now	1 year	3	3	2

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
BOILER HOUSE * FOR ROOM NUMBERS AND LOCATIONS REFER TO APPENDIX C										
4			Corrosion	There is surface corrosion on all structural elements.	4.3	10 years	10 years	1	1	2
5	B1	1 BHG2A-3A*	Column Bases	The column bases have been repaired to ACOR specifications.	4.2	1 year	10 years	1	2	2
6	B2	2 BHG2B*	Steel Window Frames	Windows on the north-west wall have significantly lost mullion strength due to corrosion and vertical mullions are tied up with timber sections in order to strengthen them.	4.25	1 year	10 years	2	3	2
7	B3	3 BH1.3*	Upper Floor slab	East side of upper floor slab has wide voids ranging up to 800mm. These voids appear to be the result of heavy impacts, which resulted in punching through of concrete and steel reinforcement.	Detailed engineers specification required	1 year	10 years	1	2	1
8	B4 & B5	4 BH1.4*	Spalling	Precast roof slab of the new building is severely affected by spalling. Bottom concrete cover is so weak that with little disturbance or vibration, it starts falling off. Falling of this material from such a height is a major safety issue. This is exposing reinforcement. Roof beams severely corroded. Water ingress through roof. Urgent repair required.	2.6, 4.4, 4.7	Now	3 months	5	4	4

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
9	-	5 BH1.4*	Upper Floor Beams and Columns	Steel Beams and columns carrying the upper floor slab are moderately affected by rust. Appear still to be adequate structurally.	4.3, 4.13	1 year	1 year	4	3	2
10	A62	BH2.1	Mezzanine Structural Steel	Moderate to severe corrosion in beams. Strip and paint required.	4.3	1 year	5 years	3	3	2
11	B9	7 BH1.1*	Floor Grates	Floor grates in the north part of the Boiler House have numerous problems including excessive corrosion, damage due to impacts, deflection and missing fixings.	4.17	I year	5 years	3	3	3
12	B6 & B7	8 BH1.1*	Ash Precipitator	Ash Precipitator is badly affected by corrosion.	4.3, 4.13	1 year	10 yearly inspection	4	3	3/4
13	B10	9 BH1.1-1.2*	Corrugated Metal Roof	Corrugated metal roof in the north section is excessively rusted and pitted and has developed small holes that are impacting on the overall corrosion problem by allowing rainwater ingress. Roof framing intact with minor corrosion.	4.6	2 years	5 years	4	3	2
14	B12	10 BH1.4*	Water-proofing	The roof structure itself is in bad condition including concrete panels. Although a later attempt at waterproofing which included paving over an original membrane has been partially successful, it is still suspect and is not considered a long-term solution.	4.14	1 year	1 year	4	4	3

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
15	B11	11 BH1.4*	South East Corner Spalling of the Precast Slab	Exterior overhang on the south east corner of the roof is severely affected by spalling. It has developed large cracks and reinforcement is exposed.	4.4, 4.7	Now	1 year	1	2	2
16	B13 & B14	12 BH1.1-1.3*	Embedded Steel Work in Masonry Walls	Corrosion of steel embedded in the east side masonry walls has caused cracking in the vicinity of steel.	4.11, 4.16	2 years	1 year	2	3	4
17	-	13 PHG10*	Western Wall of mid-level Roof	Large crack has formed due to differential brick growth in adjoining walls.	4.11	2 years	10 years	1	2	1
18	B15	14 BH1.4*	Chimney Guy Ropes & Anchor Points	Anchor points of chimney guy rope anchors at roof slab of Boiler House need repair as the concrete in the vicinity of the anchors has severely cracked which may be due to the tensile force in the ropes.	4.5	1 year	Inspection schedule to be determined by specialist	1	3	2
19	B16	15 BH1.2*	Unsecured items	On the roof truss structure of old Boiler House building, two steel angle sections which are not part of the truss are lying.	4.26	1 year	1 year	1	1	1

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
20	B17	16 PHG9*	Hoppers	Formation of soil deposits and debris in the hoppers is causing a safety hazard as this material can fall through the hopper opening. Vegetation growth is also evident. Over hoppers, roof beam severely corroded, water ingress through slab panels, minor spalling, core reinforcement visible. Urgent repair of beam, slab and roof topping required.	4.7, 4.8, 4.28	2 years	10years	3	3	1
21	-	17 BGH3A-3B*	Trip Hazards	Uneven floors, voids in the upper floor slab, deflected and damaged floor grates require repair or replacement.	4.23	1 year	1 year	2	2	4
22	B18	18 BH1.2-1.3*	Handrails	Missing and/or broken handrails on the upper floor are a safety hazard. Need repair or replacement. In addition to this, handrails on the east side of the roof are connected with the base angle through a pair of roofing screws. Extra strengthening required.	4.22	1 year	1 year	2	3	3
23		BH3.1-4	Access Ladder	Bolts in the base are missing and corroded. Require re-grouting.	4.1	Now	10 years	1	1	2
COAL LOADER, ELEVATOR TOWER AND CONVEYOR AREA										
24	A43, A51 & A52		Corrosion	All elements have surface corrosion. Weatherproofing is generally required, near columns etc.	4.3, 4.14	10 years	10 years	2	2	1

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
25	B19, B20 & B21	19 CH1.1*	Corrugated Wall Panels	Corrugated sheeting panels in the Coal Loader are in good condition internally but extensively corroded externally. Some wall panels of Elevator Tower have fallen off, while others have severely corroded, internally and externally, and have to be replaced.	4.6	2 years	5 years	3	3	2
26	-	20 CHB.1*	Loading Pits	Under the loading area of the Coal Loader, the pits are flooded with water. This could be causing damage to foundations or structure in these areas. Grates covering the pits are heavily corroded.	4.17, 4.18	5 years	10 years	3	3	2
27	A45,A46, A47, A55 B22 & B23	21 CHG.1*	Column Bases	Column bases in Coal Loader need treatment as several on the north-west have lost significant section strength and cross-sectional area due to corrosion, including the brackets but mainly the base plate.	4.2	1 year	10 years	1	1	1
28	B24 & B25	22 CHG.1*	Structural Connections	Beam-Column connections in the Coal Loader generally and particularly in the Switch Room of the Coal Loader are rusted.	4.3, 4.15	1 year	10 years	2	2	1
29	B28	23 CHG.1*	Wall Cracking	An approximately 3mm wide crack is running through the height of the East wall of Coal Loader.	4.4	5 years	10 years	1	1	2
30	B26, B27 & B29	24 CHG.1*	Floor Grates	Floor grates are either missing or heavily corroded in the loading area of Coal Loader. Need treatment for corrosion and covering of open pits.	4.17	1 year	5 years	2	2	1

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
31	-	25 CHG.3*	Trip Hazards and Headroom Clearance	In the Elevator Tower, headroom clearance is an issue. Pipes and other items need to be treated. The debris present on the Elevator Tower stairs needs to be removed.	4.1, 4.23, 4.27	1 year	1 year	1	1	1
32	B31	26 -	Timber Floor	Timber floor of the conveyor area has structurally lost its strength due to the rainwater and termites. Thorough termite inspection and repair required.	4.20	Now	1 year	4	4	3
33	B30 & B32	27 CHG.2*	Wall openings	An opening in the north wall of Coal Loader, that used to serve as an entrance to the building needs to be clad with galvanised corrugated steel sheeting as it is allowing pigeon and water ingress. Other than this, an opening of approximately 75mm wide is present in the north wall. Cladding repair required.	Cover with galvanised corrugated steel sheeting	2 years	10 years	1	1	3
34	B44		Spalling	On the external hopper there is spalling concrete on the walls and on the soffit of the slab. Exposed reinforcement is common.	4.4	10 years	10 years	2	3	3
35	A51		Roof Holes	There are holes in the roof framing, and some holes in the roof sheeting.	4.6	1 year	10 years	3	3	4
36	A53		Vent Shaft	Vent shaft connections have severe corrosion.	4.3	1 year	5 years	3	3	4
37	A54		Wind Posts	Wind post bases have completely corroded away.	4.3	1 year	10 years	2	2	1

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
EXTERNAL FACADES AND ITEMS										
38	-	28	Chimney Ladder	As notified by site staff, southern chimney ladder is not securely connected at the top of the stack.	6.1	1 year	5 years	1	1	2
39	-	29 -	Chimney Stabilisation	The guy ropes and related shock system require inspection. Consideration must be given to security of this system.	4.5, 6.1	1 year	1 year	3	3	2
40	B33	31 -	Canteen	The canteen on the south of Turbine House is resting on timber beams that may be severely affected by decay and termites.	4.20	1 year	5 years	2	2	2
41	B34 & B36	30 -	Detention Tanks	Vegetation growth around in-ground water tanks needs to be cleared. An investigation is required for any possible link between Coal Loader pit flooding and the detention tanks.	Investigate by dye testing after pumping out Coal Loader pits.	2 years	10 years	3	3	2
42	B37 & B38	32 -	Masonry Wall Cracking	Wide cracks are present in the south wall of the Boiler House and north wall of the Turbine House.	4.11	5 years	10 years	3	2	2
43	B39	32 -	Lintel Corrosion	Lintel on the north west corner of the exterior wall of the Turbine House is severely corroded and has cracked the brick wall.	4.3, 4.11, 4.16	2 years	10 years	1	1	2
44	B35 & B40	33 -	Masonry Wall	Wide crack that is running from the edge of the roof slab to the foundation of south wall of Boiler House.	4.11	2 years	10 years	3	2	2

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
45	B41	34 -	Water Tank		Demolish or strengthen supports.	1 year	5 years	1	3	3
46	B42	35 -	Guy Ropes and Shock System for Chimneys	Foundations for guy rope anchors of the chimneys are located outside the premises fence and are vulnerable to vandalism. Fenced area needs to be increased such that those foundations come within the fence.	Fence off the area.	1 year	1 year	2	2	2
47	B43	36 -	North Wall of the Turbine House	Presence of cracks in the parapet and above the lintels. Vegetation growth in the cracks is evident.	4.11, 4.28	1 year	1 year	2	2	1
48	-	37 -	North wall of Ash Plant	Concrete wall is affected by minor spalling, on the north face.	4.4	2 years	5 years	1	2	2
49	B44	38 -	Unsecured Items	Timber sections are lying on the over hang of west wall of Switch House. Need to be removed, as their presence is a safety hazard.	4.26	1 year	1 year	1	1	2
50	B45 & B46	39 -	Waste Removal	Debris accumulated on the south east side of the power station needs to be removed.	4.27	2 years	1 year	1	1	1
51	B47, B48 & B49	40 -	Crushed and Cracked Concrete	Severely crushed and cracked concrete found on the west side of Switch House.	4.4, 4.12	5 years	10 years	3	3	3

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
52			Weathering	The sandstone sill on the north wall is delaminating, and the string course is weathered.	4.11, 4.26	1 year	10 years	1	2	3
53	A56		Broken Bricks	There are broken bricks at South East corner of the boiler house.	4.11	5 years	10 years	1	2	3
TURBINE HOUSE, ADMINISTRATION BUILDING & PUMP HOUSE										
54	A94	THGE1 & THG C1	Column Bases	Two steel column bases have been repaired as per Acor specifications. Remaining column bases have moderate corrosion.	4.2	5 years	1 year	2	3	2
55	B50, B51 & B52	41 PHG.7-9* & PHG 1B	Corrugated Metal Roof	On the east side of Turbine House, roof panels are missing out of the roof. Wide openings are causing water damage during rain and pigeon ingress. Damp on the walls due to holes in the roof is causing peeling paint. Many holes have been formed in the rest of the roof due to corrosion and pitting. Overall situation of the roof is very bad and the whole roof needs to be replaced.	4.3, 4.6, 4.14	1 year	5 years	3	4	2
56	B53, B54, B55, B56 & B57	42 THGB.1-D.1*	Trip Hazards and Headroom Clearance	Open pits in the ground floor of the Turbine House, due to the removal of equipment are trip hazards. Need to be covered. In addition to this, headroom clearance is an issue on the ground floor.	4.1, 4.23, 4.24	1 year	1 year	2	3	4

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
57	B58 & B59	43 THGA.1*	Spalling of Slabs	First floor slab in the pump room on the east side of Turbine House has severe problem of spalling. Reinforcement is exposed and extensively corroded.	4.4	Now	5 years	3	3	1
58	B60 & B61	44 THGA.1*	Floor Beams	Severe corrosion in floor beams carrying first floor slab located in the north-east of Turbine House. Also spalling concrete	4.3, 4.13	Now	5 years	3	3	2
59	B62, B63 & B64	45 THGA.1*	Floor Beams	First floor beams on the north-east side of Turbine House have lost a significant part of the flange due to rusting caused by water leakage.	4.3, 4.13	Now	5 years	3	3	2
60	B65 & B66	46 THGE.1*	Stormwater Pipes	Stormwater pipes located in the south-east of Turbine House on the first and second floors are leaking heavily causing flooding and damaging timber floor.	4.19	Now	1 year	3	3	1
61	B67	47 THGD.1	Power Cables	Power cables located on the first floor of Turbine House, are sub-merged in the pool of water accumulated by heavy leakage of stormwater pipes.	Secure the cables and treat water pipes as per 4.19	Now	1 year	1	1	2
62	B68	48 THGA.1-C.1*	Gutters	Gutters in the Turbine House are in very bad condition. Require replacement.	4.19, 4.28	1 year	1 year	2	2	1

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
63	B69, B70, B71, B72, B73, B74 & B75	49 AS3.13-18*	Timber Floors and Walkways	Timber floor on third level of Administration Building is severely affected by decay due to heavy leakage of stormwater and accumulation of water on the floor. Due to the loss of strength and bearing capacity, this floor is not safe to walk on. Walkways on the second level of Turbine House have the same strength problem as they are affected by the rainwater ingress through the holes in the roof sheet and by termites.	4.6, 4.19, 4.20	1 year	10 years	3	3	2
64	B76	50 ASG.1*	Unglazed Doors	Unglazed doors in the Administration building are a safety hazard due to broken pieces of glass.	4.1	1 year	10 years	1	1	2
65	B77 & B78	51 TH1B.1*	Handrails	Handrails on the first floor of Turbine House have missing or damaged sections. Need to be repaired/ replaced. The handrails on the second floor have mild corrosion and damaged base plates.	4.22	1 year	1 year	2	3	3
66	-	52 THGD.1*	Floor Gratings	Floor gratings over deep pits are missing in the Turbine Hall. Most of these pits are deep and full of water. All pits need to be covered or fenced off.	4.1, 4.9, 4.17	1 year	1 year	2	2	4
67	B79 & B80	53 THGA.1*	Vegetation	Vegetation growth through the cracks in the roof and exterior wall on the north has to be removed so that the cracks can be inspected and repaired.	4.28	1 year	1 year	1	1	1

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
68	B81	54 THGC.1*	Unsecured Items	A steel angle is lying on the top of east wall, causing a safety hazard. Needs to be removed.	4.26	1 year	1 year	1	1	1
69	A85	PH1.2	Brick Wall	A section of the outer brick wall is damaged and unsupported.	4.11	1 year	10 years	3	3	4
70		AS 2.6-8 & AS 3.14-17	Water Damage	Damp is penetrating all walls. The ceiling is damaged, allowing water ingress causing decayed flooring. The waterproofing of the exterior needs to be ensured.	4.14	1 year	1 year	4	3	4
71	A88		Corrosion	The main roof trusses and combined steel timber purlins have minor surface corrosion.	4.3	5 years	10 years	2	2	2
72			Roof Hatch	The roof hatch is in poor condition and needs to be replaced.	4.14	Now	1 year	1	1	2
73	A89		Roof Sheeting	The majority of the surface of roofing is either missing or highly corroded.	4.6	Now	5 years	4	4	4
74			Box Gutter	The box gutter is deteriorated.	4.3	Now	5 years	1	1	3
75	A95	Admin L2	Corrosion	There is moderate to severe corrosion on floor slab joists	4.3	1 year	5 years	3	4	4
76	A90	Admin L2	Floor	The false timber floor is severely decayed. The concrete slab underneath appears ok.	4.20	1 year	5 years	3	3	4
77		Admin L3	Floor	The top floor slab is cracking.	4.4	5 years	10 years	2	2	2

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
78	A91	Admin L4	Floor	There is moderate corrosion on the steel floor joists.	4.3	5 years	10 years	2	3	2
79	A92	Admin L4	Roof	Sections of roof are missing.	4.6	1 year	5 years	3	3	1
SWITCH HOUSE & BATTERY ROOM										
80	A4-6		1st Floor	On the 1st floor slab the soffit is spalling exposing reinforcement. The steel beams are in good condition with mild spot rust. There is a hole in the south end that is uncovered.	4.3, 4.4, 4.24	1 year	10 years	2	3	2
81	B82 & B83	55 A1.5*	2ND Floor Slab	Second floor slab on the north side has a cut out section and the reinforcement is exposed. This has resulted in a void of approximately 100mm between the slab and the beam. In addition to this, an opening of approximately 300mm diameter is present on the east side of third floor slab.	4.4	1 year	10 years	1	2	2
82	A11-14 & A16, A22, A23 B84-88	56 1.7-1.8,2.9,2.10 *	Beams and Walls Cracking	Concrete and masonry wall cracking is an issue throughout second and third floor. Masonry wall cracking includes cracking of east and west wall on second level and north wall on third level. Concrete cracking includes the cracking of reinforced concrete beams on east of second floor and under the 3rd floor in the east stairwell. There is some calcite leaching.	4.4, 4.11	2 years	10 years	3	3	2

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
83	B89-92	57 2.5-2.8*	Concrete Slab Cracking	Third level floor slab on the west side is badly cracked. Cracks ranging up to 10mm are causing slab reinforcement corrosion.	4.4	1 year	5 years	3	3	2
84	A7, B93	58 G.13D*	Damaged Concrete Column	Damaged column in the south part of ground floor.	4.4	1 year	10 years	1	1	2
85	A19, B94 & B95	N/A	Water Proofing	Water proofing is a general issue on second and third floors. The stone string course is water damaged on the west façade pump house.	4.14	1 year	5 years	3	3	1
86	B96 & B97	59 1.8-1.9*	Floor tiles	Second floor tiles on the south side of Battery Room are coming off. Need repair.	4.23, 4.29	2 years	10 years	1	1	2
87	A8, A9, B98 & B99	60 2.9-2.10*	Trip Hazards	Uneven floor and presence of steel column bases in the third floor are causing a safety hazard. In addition to this, wide openings in the floor slab of the second floor are covered with timber panels. Openings have to be covered properly.	4.23, 4.24	1 year	1 year	1	2	3
88	-	61 G.3*	Uncovered Drains	Wide drains in the north part of the ground floor of the Switch House are uncovered.	4.9, 4.23, 4.24	1 year	1 year	1	2	2
89	B100	62 1.12*	Vegetation	Vegetation growth on the west exterior side of Battery Room needs to be cleared.	4.28	1 year	1 year	1	1	1

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
90	B101	63 G.13E, 1.12, 2.14*	Unglazed Windows	Windows on the south and west walls of Battery Room are either unglazed or have broken glass. This is an issue for both site security and water proofing.	4.14, 2.7.8	2 years	5 years	2	2	1
91	B102	64 1.4*	Handrails	Handrails on the exterior side of east wall of second floor are twisted and detached from the base.	4.22	1 year	1 year	1	1	3
92	A3	-	North End Channel	The north end channel has been recorded. It is uncovered and in ok condition.	-	5 years	10 years	-	-	-
93	A10	-	Façades	The east façade of the switch and the west façade of the pump house were not inspected due to inaccessibility.	-	-	-	-	-	-
94	A15	-	Roof Membrane	The roof membrane is compromised. Vegetation is growing on the floor, allowing moisture into the rooms below.	4.28	5-10 years	10 years	1	2	2
95	A17	-	Gable End	Vertical and diagonal cracks in the gable end due to corroding lintel and fitments.	4.16	5 years	10 years	1	2	2
96	A18	-	Corrosion	There are corroded lintels on the west façade of the pump house	4.16	10 years	10 years	1	2	2
97	A26	-	Box gutter	The box gutter in the roof has failed.	4.3	1 year	10 years	1	2	3
98	A29	-	Downpipe	There is a broken downpipe and header on the west façade.	4.3	5 years	10 years	1	1	2

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
CONTROL ROOM & 25 CYCLE SWITCH HOUSE										
99	B103 & B104	65 CS1.1*	Wall Cracking	East wall of the Control Room has cracks.	4.11	5 years 10 years	10 years	1	1	2
100	B105	66 CS1.3*	South Exterior Wall Cracking	South exterior wall along the balcony of the 25 Cycle Switch House has a vertical crack.	4.11	5 years	10 years	1	1	2
101	A39 B106	67 CS2.2*	West Wall of the 25 Cycle Switch House	West wall of the 25 Cycle Switch House is cracked at the window level.	4.11	5 years	10 years	1	1	2
102	B109 & B110	69 CS2.2*	South-West corner of the 25 Cycle Switch House	Diagonal crack on the south wall of the 25 Cycle Switch House just above the window. Many surface cracks were also found on the west wall. See attached photos for details.	4.11	5 years	10 years	1	1	2
103	A32 & A33		Cracking	There is a 3mm diagonal crack in the north east masonry wall.	4.11	5 years	10 years	1	1	2
104	A35		Cracking	The east wall has a 2mm diagonal crack.	4.11	5 years	10 years	1	1	2
105	A36		Cracking	There is a vertical crack in east wall from window	4.11	5 years	10 years	1	1	2

No.	Photo No. A – 2010 B – 2003	Map Location	Item	Condition	Specification Reference	Maintenance Reference		Risk Assessment		
						Priority of Work	Ongoing Monitoring	Problem Category	Expense Category	Heritage Impact
106	B111	70 CS2.2*	Vegetation	Vine on the south exterior wall of the adjacent building has to be removed. Possibility of surface cracks on the exterior face.	4.28	1 year	1 year	1	1	1
107	A31		Spalling	There is minor spalling concrete on the soffit resulting in exposed reinforcement.	4.4	5-10 years	10 years	1	1	2
108	A30		Water Damage	There is a hole in the roof causing water damage.	4.14	1 year	1 year	3	3	3
109	A40, B107 & B108	68 CS2.2*		Ceiling panels are missing	4.14, 4.15, 4.19	1 year	5 years	2	2	2
110		CS1.2		This section was inaccessible, however peeling paint on the soffit was visible	-	5 years	10 years	1	1	2
111		CSG.2		This section was inaccessible but appears ok.	-	-	-	-	-	-

4.0 TYPICAL REPAIR SPECIFICATIONS

The following specifications are outline specifications for the purposes of the Conservation Management Plan.

Appropriately qualified Engineers, Architects and specialists will be required to prepare detailed specifications prior to letting works.

4.1 SAFETY PROCEDURES

4.1.1 Site Induction

Current visitor log and induction should be maintained.

The site is not considered suitable for access by children, elderly or disabled persons in its current state.

4.1.2 Hazard Identification

Trip hazards, headroom projections and the like should be marked with safety tape. Unsafe handrails should be marked unsafe. Unsafe areas of floor should be barricaded off.

4.1.3 Monitoring

Certain parts of the site have the potential for relatively rapid change in their safety status. In particular the precast concrete roof panels in the southern half of the Boiler House are subject to spalling which is occurring at an undetermined rate. Visual inspection should occur every three months. Refer to Section 4.7.

4.2 COLUMN BASE REPAIRS

- Provide temporary propping to the structure over supported by the column.
- Grit blast or power wire brush and grind to remove rust and expose metal suitable for welding.
- Weld in new web and flange plates to Engineer's detail.
- Prepare and paint to comply with AS/NZS 2312 for long term protection to suit the relevant exposure classification.

4.3 CORROSION

- Carry out detailed inspection of all ferrous elements (steel or iron) and identify any elements with significant loss of cross-section (say greater that 10%).
- Elements to be classified as follows:

1. Elements with significant loss of cross-section
2. Elements with surface corrosion in an exposed environment including under awnings or floors but outside walls.
3. Elements with surface corrosion in an internal environment, however, with high exposure (eg, near open door, open window, non-weather proof area, wet area, area near salt water cooling conduit etc.)
4. Elements with surface corrosion in an internal environment without significant exposure.
5. Elements with unknown corrosion due to inaccessibility to inspect or paint.
6. Elements with adequate paint coating.
7. Elements requiring painting for aesthetic reasons.

4.3.1 Remedial works

Classification	*Action*
1	Refer to an Engineer for detailed repair specifications then prepare and paint within time frame specified by the Engineer. See also Section 4.13.
2	Prepare and paint within 12 months.
3	Prepare and paint within 12 months.
4	Either monitor on an annual basis or prepare and paint within 24 months.
5	Expose for inspection.
6	Monitor on an annual basis.
7	Prepare and paint as directed.

4.3.2 Preparation and Painting

- Preparation and painting to be in accordance with AS/NZS 2312 Table 3.1 for long term protection.
- The selection of system should have regard to future usage if known.
- The selection of system shall take account of:

  - Any applied Fire protection required.

  - Not obscuring the detail of the fabric (ie. do not use very thick coatings on fine or intricate steelwork)

  - Non-slip finishes where required.

4.4 CONCRETE REPAIRS

Inspect concrete and classify damage as either:

1. Major spalling ie. spalling exposing severely rusted reinforcement over an area of more than 300mm².
2. Minor spalling ie. spalling exposing reinforcement less than 300mm².
3. Cracking with evidence of rust staining.
4. Cracking without evidence of rust staining.

4.4.1 Remedial Works

Classification	*Action*
1	Take concrete samples to identify condition of concrete and extent of carbonation and chloride attack and other tests which may be considered relevant in consultation with testing laboratory. Depending on results either repair spalling or consider major remedial works.
2	Repair spalling.
3	Break out to expose reinforcing. Reinspect for further direction.
4	Either monitor cracks or repair.

4.4.2 Spalling Repair

1) Provide propping as necessary.
2) Breakout and remove all defective concrete using suitable mechanical means. Defective and drummy concrete shall be broken back to a sound alkaline base.
3) All corroded reinforcement shall be exposed for the complete diameter and thoroughly cleaned by abrasive methods until at least 50 mm of non-corroded steel is evident.
4) The concrete substrate must be mechanically abraded (with needle gun or mechanical wire brush). The surface must be sound, free from cement grout, laitance, loose or segregated material, voids or flaws and substances which could interfere with the bond between old and new concrete (oils, grease, etc). The surface must not be powdery or crumbly, and must exhibit adequate tensile strength.
5) Feathered edges to repairs are not permitted and chiselled or saw cut edges should be prepared to give a fine gripping texture prior to repair.
6) Advise Engineer for inspection.
7) Provide additional reinforcement adjacent to all existing reinforcement, which exhibit a loss of area in excess of 20% and lap as directed by Engineer. Size of additional reinforcement shall be determined after defective concrete has been removed.

8) Apply two coats of Sika Mono Top – 610 to all exposed reinforcement to the manufacturer specifications.

9) Apply one coat of Sika Mono Top – 610 to the concrete surface to the manufacturer recommendations. Note that the substrate must be prewetted and in saturated surface dry condition. The subsequent repair mortar must be applied whilst the Sika Mono Top – 610 Bonding Bridge is still wet. Wet on wet application is critical to ensure a good homogeneous bond.

10) Apply Sika Mono Top – 615 HB repair mortar in strict accordance with manufacturers specifications to restore line and level, ensure repair site is filled, voids are eliminated and the repair mortar is properly compacted.

11) Sika Mono Top – 615 HB should not be used for thicknesses less than 3 mm or greater than 80 mm in a single application. Where the latter is required more than one application is necessary.

12) Locally build-up the concrete section in order to achieve correct covers. Ensure line and level of built-up areas blend with adjacent concrete sections.

13) Ensure that expansion joint gaps are not bridged during the application of the high build repair mortar.

14) Cure repairs in strict accordance with Sika Australia Specifications.

4.4.3 Crack Repair

Grout up with proprietary repair compound (eg. Sika or Epirez). Cut out to required profile and repair joint as per supplier's specifications.

4.5 CHIMNEY GUY ROPES AND ANCHORS

The guy ropes and associated fixings including springs, dampers, d-rings, shackles and the like should be inspected by a rigging specialist who should recommend:

- Any immediately required repairs and maintenance
- Periodic ongoing maintenance and monitoring

4.6 CORRUGATED METAL ROOF SHEETING

4.6.1 Immediate Priority

There are no immediate priority works necessary.

4.6.2 Long Term work

Survey roofing to identify:

Category of Damage	*Description*
1	Cladding and gutters missing
2	Cladding and gutters which are perforated
3	Cladding and gutters which are rusted but not perforated with expected future life of less than 10 years
4	Cladding and gutters which are rusted but not perforated with expected future life of greater than 10 years
5	Cladding and gutters in good condition

Carry out work as follows:

Category of Damage	*Description*
1	Replace with profile to match existing
2	Replace with profile to match existing
3	Consider either preparation and painting or replacing with profile to match existing
4	Prepare and paint
5	Identify future painting programme.

4.7 PRECAST ROOF PANELS (Boiler House)

4.7.1 Monitoring Works

1. Carry out a rigorous monthly visual inspection from the high level walkways and with binoculars.
2. A detailed inspection by cherry picker hoist should be carried out within three months with removal of any loose, drummy or otherwise suspect material at that time.

4.7.2 Repair Works

1. Subject to findings of inspection, a detailed repair specification should be prepared.
2. At this stage it is expected that the specifications would be similar to 4.4.2 but may vary in specifics.
3. Consideration should be given to the installation of a catch structure below the roof if, upon inspection, it cannot be reasonably guaranteed that material will not fall.
4. Consideration should also be given to removal and replacement of the roof panels with a new roof structure.

Removal or lifting of panels may prove to be necessary in any event to allow access to repair corrosion to steel work.

4.8 HOPPERS

The northern coal hoppers appear to have a lining which is possibly a cementitious or epoxy coating but could be a build up of cemented coal dust. It appears to be an applied coating and the material is cracked and spalling. The hoppers should be accessed by rope access maintenance specialists for inspection. Loose material should be dislodged and removed and the hopper hatches should be fixed in the closed position so that any future dislodgment of lining will not fall through the hatches.

At the time of inspection, the hoppers should be checked for corrosion and treated as per section 4.3.

4.9 SLABS WITH PENETRATIONS

4.9.1 Immediate Action

Check and secure safety covers over penetrations. Refer to section 4.25 for details.

4.9.2 Long-Term Action

Repair specifications to be prepared by a structural engineer specific to each location. Repair is expected either to consist of repair of edges with cutting back and corrosion protection to projecting reinforcement and then fitting permanent safety covers or preparation, installation of reinforcement and placing of new concrete to infill voids. Refer also to section 4.4.2.

4.10 CANTILEVERED WALKWAY

Cantilevered walkway has been removed.

4.11 MASONRY WALL CRACKING

4.11.1 Impact Damage

Remove loose material and relay bricks using as close a match in brick work and mortar as is possible and re-using existing bricks where possible (refer photo B37).

4.11.2 Lintel Corrosion

Prop as required. Remove and replace corroded lintel with new galvanised or stainless steel lintel (as directed by the engineer) and repair brickwork (refer photo B39)

4.11.3 Brick Growth Cracking

Fit a backing rod and de-bonding tape and seal the joint with a colour matched polyurethane sealant recessed 5mm from the outside face.

4.11.4 Embedded Steelwork Corrosion

Refer to Section 4.16

4.12 BROKEN CONCRETE IN CABLE TRAYS (REFER PHOTO B47)

Unless required to be repaired to original profile remove loose or damaged concrete. Cut back projecting reinforcement to give 40mm repair cover. Repair with an epoxy compound as per section 4.4.

4.13 STEEL FLOOR AND ROOF BEAMS WITH STRENGTH REDUCTION BY LOSS OF CROSS-SECTIONAL AREA

Temporarily prop the supported structure each side of the beam and lift clear if possible. Otherwise remove beam for offsite repair, corrosion treatment or replacement. Note that propping to roof beams will be an extensive operation due to the heights involved.

1. Engineer to assess residual capacity of section and direct either corrosion protection treatment or repair/strengthening.
2. Assess whether repair in situ is possible and whether cladding and/or supported structure has to be temporarily propped and partially removed.
3. Assess whether beam has to be removed, repaired and replaced.
4. Assess whether beam has to be removed and replaced with a new beam.

Repair may typically consist of removing defective material and welding in new plate sections or stabilising defective material and welding on additional plates.

Refer to Section 4.3 for corrosion protection.

4.14 WATER PROOFING

1. Assess nature of defect (eg rising damp, roof leak, wall leak, failed pipework).
2. Determine cause of defect (eg failed damp course, damage membrane, failed brick joints, disconnected pipes).
3. Repair to detailed specification prepared by an Architect or specialist waterproofing Contractor.

4.15 CORROSION TO STRUCTURAL CONNECTIONS

Carry out a detailed survey and classify generally as per section 4.3

Treat the base plates, fin plates, end plates, cap plates, brackets and cleats as for the remainder of the steel work.

Where bolts show any sign of corrosion sufficient to affect their structural capacity, they should be removed and replaced with new 8.8 grade galvanised steel bolts.

The engineer is to direct the type of bolt for each application (eg. TB, TF).

When removing and replacing bolts it may be necessary to temporarily prop the member being supported by the connection.

Alternatively, subject to load checks in certain circumstances bolts could be sequentially replaced.

4.16 EMBEDDED STEELWORK

Inspect all steelwork embedded into walls and classify as follows.

1. External steelwork embedded in external wall that still carries out a function.
2. External wall steelwork embedded in external wall that is now redundant.
3. Internal steelwork embedded in external wall and projects to outside face and still carries out a function.
4. Internal steelwork embedded in external wall and projects to outside face but is now redundant.
5. Internal steelwork embedded in internal wall.

4.16.1 Remedial Works

Classification of Damage	*Action*
1	Closely inspect for corrosion and any cracking of surrounding brickwork. If corroded and/or cracked, provide temporary props and break out external skin of brickwork/concrete to 110mm depth for further inspection and direction of corrosion treatment. If no corrosion or cracking then make good and monitor on a 12 month basis as per "Corrosion" section.
2	Inspect closely. If corroded and/or cracked then break out and remove. If the item is an essential part of the heritage interpretation of the site, mark the location using contrasting brickwork. Set out in a neat and precise pattern. If no corrosion or cracking then monitor on a 12 month basis as per "Corrosion" section.
3	Closely inspect. If corroded or cracked than break out at external skin to 110mm depth for further inspection and direction of corrosion treatment. Prop if required. If no corrosion or cracking then monitor on a 12 month basis as per "Corrosion" section.
4	Inspect closely. If corroded and/or cracked then break out and remove. If the item is an essential part of the heritage interpretation of the site, mark the location using contrasting brickwork. Set out in a neat and precise pattern. If no corrosion or cracking then monitor on a 12 month basis as per "Corrosion" section.
5	Closely inspect and refer to engineer if any damage noted for further direction.

4.16.2 Cracked Brickwork

After removal or treatment of the steelwork, remove damaged bricks and rebuild cracked sections of brickwork. Where bed joints have lifted but not excessively (1.e. by no more than 5mm) then rake out joint and repack with 1:1:6 mortar. Except where noted as contrasting to indicate removed steelwork, use matching bricks as close as is possible in repair works.

Subject to engineer's direction, bed joint reinforcing may be specified in certain instances.

Where steelwork is to be retained in situ leave mortar packing around steel work 10mm back from external face and seal all round with a colour matched polyurethane sealant.

4.17 FLOOR GRATES

4.17.1 Corrosion

Carry out a detailed inspection and prepare layout plans of floor grates. Where floor grates have corroded sufficiently to have caused significant loss of cross-section they should be removed and replaced with a new galvanised steel floor grate of a profile as close as possible to the original section. Where floor grates have surface corrosion only, they should be removed, blast cleaned and hot dip galvanised.

4.17.2 Clips and Fixings

Clips and fixings, which are either corroded or missing, should be replaced with new clips and fixings.

4.17.3 Damage

Where floor grates are bent, broken or otherwise damaged, they should be removed and replaced with new galvanised steel floor grates.

Refer also to section 6.7.

4.18 COAL LOADER PITS

Test the water in the pits to establish if fresh or saline and to check presence of any adverse chemicals (eg sulphates)

De-water pits by pumping out and identifying the source of inflow and sealing off.

Inspect for any damage and direction of remedial works.

It may be necessary to install permanent sump pumps to ensure that the pits remain dry subject to inspection findings.

4.19 STORMWATER SYSTEM

Carry out of full site survey of above ground and in-ground stormwater disposal systems including gutters, downpipes, pits and in-ground pipework.

Remove broken or damaged pipes and replace with new mechanical joint or push fit cast iron pipes. FRC may be considered as an option.

Prior to reconnecting, the in-ground system is to be inspected with CCTV cameras to check pipe condition, debris blockage and to identify any repair necessary to ensure adequate discharge to the harbour.

Identify any existing pollution control systems (eg silt arrestor pits) and clean out as necessary.

Refer also to Section 4.6 regarding roofing and guttering.

4.20 TIMBER FLOORS AND WALKWAYS

All timberwork is to be closely inspected for termite damage, decay, deflections, mechanical damage or insecure fixings and bearings.

Where visual inspection is not considered reliable and in particular at bearings and positions of timber embedment into walls use drill testing with a 6 or 8mm drill bit to confirm soundness.

For localised sections of unsound timber, replace with seasoned hardwood or treated softwood as appropriate for the situation. For larger areas of unsound timber flooring, remove and replace with galvanised steel grates or galvanised steel tread plate as appropriate for the situation. In some instances, replacement flooring may not be warranted after removal of timber.

4.21 CONVEYOR WALKWAY FLOOR

The timber floor and supporting timber structure for the conveyor walkway floor is severely termite damaged and is unsafe to walk on and presents a potential danger there to falling timberwork in the event of failure.

Because access to inspect and repair is a major safety hazard, it is recommended that all the timberwork is removed and replaced.

Progressively remove timber boards and joists and replace with structural plywood decking laid over structural steel framing fixed to existing steelwork by site welding.

Prior to removing existing fabric, make a photographic record in accordance with NSW Heritage Manual Guidelines.

Until this is done each end of the walkway should be barricaded with signage to prevent access.

4.22 HANDRAILS

4.22.1 Corrosion

Where handrails have corroded significantly to have any loss of cross-section, they should be removed and replaced with new handrails of a material as close as possible in section. Where handrails have surface corrosion only, they should be prepared and painted.

4.22.2 Damage

Where handrails are bent, broken or otherwise damaged, they should be removed and replaced with new handrails as close as possible in section to the existing ones. While replacing, care has to be taken of the following:

1. Bolts should not be overstressed and the applied torque should not exceed that recommended by the bolt manufacturer.
2. All commercial bolts used should be tightened so that the joined parts shall firmly drawn together using a standard ring spanner or pneumatic impact wrench.
3. Bolts should not be used to force fit the abutting material together.

4.22.3 Capacity and BCA Compliance

All handrails should comply with current code and BCA requirements. This may necessitate renewing some or all handrails on the site.

New handrails should have due regard to interpreting the original industrial nature of the site.

Where handrails are considered to contribute to heritage significance, it may be necessary to retain them in place and fit additional handrails adjacent.

4.22.4 Fixings

1. Corroded fixing bolts are to be replaced with new galvanised bolts.
2. Some handrail fixings have been replaced with inadequately sized fixings (Boiler House roof external walkway). Repair handrail and replace bolts.

4.23 TRIP HAZARDS

1. Remove all debris and waste materials from floors.
2. Survey floors and identify all access routes.
3. Where an access route is not defined by handrails or the like then the whole floor area should be considered an access route.
4. Identify all projections and steps which could constitute a trip hazard and determine:

- If they can be removed (bearing in mind both physical and heritage constraints)
- If they can be avoided by suitable fencing off or covering
- If they require remedial work eg. topping, infilling, ramping etc.

5. Both future use and heritage significance of elements will be important in selection of remedial works. For example, screeded toppings may be appropriate where interpretation of the original floor form is not critical whilst raised floors may be more appropriate for areas of heritage significance where machine bases, trenches and the like are important for interpretation purposes.

4.24 COVERING OPENINGS

Where openings are unprotected by adequate railings or existing covers are inadequate, they should have new covers.

Subject to heritage considerations covers may consist of:

1. Fitting galvanised angles and trimmer beams to the inside faces of the openings set down sufficiently from the opening top rim to allow flush installation of a cover.
2. Covers to be either a galvanised steel mesh gratings where through visibility is considered important or proprietary tread plate where through visibility is not a factor.
3. Covers to be securely clipped or screwed down to finish flush with the rim top edge.

4.25 STEEL WINDOW FRAMES

1. Carry out detailed inspection with a specialist contractor.
2. Schedule elements requiring:

- Reglazing
- Preparation and painting only
- Putty and gasket repair
- Strengthening with plates or the like
- Replacement

3. Schedule short-term stabilisation works (eg. localised steel or timber bracing) and removal of any loose or dangerous material.

4. Schedule:

- Temporary bird proofing
- Temporary weather proofing
- Permanent re-glazing

4.26 UNSECURED MATERIAL

Material which is unsecured and has the potential to fall causing harm or damage should be either secured or removed.

Examples include pulleys, shackles and the like suspended from ropes or wires and loose or partially secured sheets of cladding, perspex or glass.

Refer also to section 6.5 Facades and to the schedules in section 3.

Where an item to be removed has the potential to have heritage significance, its location should be recorded and labelled identifying where it came from and should be put in approved storage.

4.27 WASTE REMOVAL

4.27.1 Hazardous Waste

It is understood that all asbestos and hazardous materials have been removed from the building under a previous contract. Consequently hazardous waste is not within the scope of this report.

4.27.2 Waste Constituting an Immediate Danger

To be removed either offsite or to a controlled storage area on site (eg. debris on ladders, walkways and in pedestrian access areas).

4.27.3 Waste Constituting a Potential Danger

To be removed either offsite or to a controlled storage area on site (eg. unsecured waste piles).

4.28 VEGETATION

The site requires general removal of weeds. All vegetation growing on the fabric should be removed including on walls, roofs and in gutters and parapets.

Removal to include poisoning of roots. Where removal of vegetation exposes damage or the potential for damage (eg. roots dislodging or cracking masonry), such damage is to be repaired as per specifications described elsewhere or as per specific specifications.

There may be circumstances where the removal of vegetation can destabilise underlying structure (eg. cracked parapets). In these circumstances temporary works may be required to restrain the fabric whilst vegetation is removed.

An ongoing maintenance program will be required.

4.29 FLOOR TILES

Where floor tiles are loose, missing or constitute a slip hazard, inspect and repair substrate as required and then refix or replace to an Architects specification in line with the heritage requirements of the Conservation Management Plan.

5.0 MAINTENANCE AND MONITORING RECOMMENDATIONS

Ongoing maintenance and monitoring will be required at the site.

The prioritisation of works and the recommended periods between inspections are outlined in Section 3.0. Priorities are referred to by a time frame in which either a detailed inspection and reassessment is required or in which the works should be completed. Priorities were assessed at the time of this report but may change with changed circumstances or further detailed inspection.

These are necessarily guidelines only and may require modification as the maintenance history of the site builds up (ie it may become apparent that some items require more regular maintenance than expected and other items may prove to be more durable than expected).

In addition, to assist in assessing the expense and seriousness of problems a system of categorisation has been used. The heritage impact is for guidance only and would require detailed analysis of actual remedial works proposals and specifications.

Problem categories:

1. Readily understood and localised problem.
2. Problem occurring in several locations but minor and quantifiable moderate problems
3. Major problem either widespread or localised
4. Widespread and possibly undefined problem with possible unforseen major ramifications

Expense categories:

1. Minor expense which could be expected to occur in the normal course of maintenance.
2. Minor expense as part of a refurbishment contract
3. Moderate expense as part of a refurbishment contract
4. Major expense which can be quantified and might require a separate contract.
5. Major expense, but which may be difficult to quantify.

Heritage categories: (the heritage Impact would depend on the detailed specification, however, the categorisation is based on a like with like replacement policy where possible)

1. Recommended to improve heritage significance.
2. No effect on significance
3. Low impact on significance SOHI* may be required
4. Moderate impact on significance would require SOHI*
5. Potential severe effect on significance would require SOHI*

*SOHI – Statement of Heritage Impact.

5.1 ACCESS

Monitoring and maintenance require suitable access. This is particularly important since the heritage significance of the buildings dictates that elements will be required to be maintained for periods for longer than those envisaged by the original designers. In addition maintenance may need to be performed by staff who are not experienced with power station maintenance.

There are currently in place some access facilities (eg the monorail beam for façade access to the boiler house east wall), however these are unlikely to comply with present day safety requirements.

A thorough access audit is required addressing in particular ladder access, suspension systems for building maintenance units, safety anchor points for roof and façade cleaning and repair (both internally and externally) and hand railing.

The selection of access systems will need to take into account both heritage considerations and future uses.

Certain elements of the site are always likely to require specialist access personnel (eg the chimneys).

5.2 MONITORING AND INSPECTION

Section 3 breaks monitoring into discrete categories:

- annual
- five yearly
- ten yearly

Whilst certain elements may be expected to last longer than this between inspections it is unlikely that data can be accurately kept and recovered on a cycle longer than ten years.

Periods of monitoring must necessarily be treated as minimum standards.

Events that would trigger the need for immediate inspection might be:

- severe high wind
- severe rainfall
- seismic event
- accident
- fire
- explosion
- alteration to the fabric (ie works taking place)
- structural damage or distress (eg settlement)
- change of use
- change of occupancy that increases level of risk or other change of circumstance

6.0 DETAILED SPECIALIST INVESTIGATIONS REQUIRED

This section remains unchanged since our previous report of 2003. Detailed investigations are required for the following items

6.1 CHIMNEY STACKS

Chimney stacks to be investigated by a specialist structural engineer for the following

- Corrosion
- Failed fixings and connections
- Guy ropes and guy rope connections to the Chimneys
- Condition and safety of ladders

6.2 TIMBER FLOOR OF CONVEYOR WALKWAY

The timber floor of the Conveyor Walkway is severely affected by termites. A detailed termite inspection by qualified people is required in order to determine the extent of damage and whether repair is practical. This floor is considered dangerous and should only be assessed by cherry-picker hoist or rope access.

6.3 PITS IN THE COAL LOADER

Pits in the Coal Loader are flooded with water. The reason for this flooding is unclear. There are water retention tanks on the east of the Coal Loader and water might be seeping from there through the pit walls or openings in the pit walls. A detailed investigation is required to determine the cause, if repairs are required and method of repair.

6.4 THE COOLING SYSTEM CHANNELS

Seawater was used to cool the condensers. This water was drawn from White Bay via reinforced concrete conduits and circulated under the Turbine House.

Steel and ironwork in the vicinity of these conduits and the openings to the conduits including the central gates and valves are severely corroded.

It is likely that the reinforced concrete conduits are also subject to attack from the corrosive seawater.

These conduits should be inspected by specialist access teams (probably divers) to determine if damage is severe enough to warrant any intervention.

Intervention is only likely to be necessary if damage to the conduits is considered likely to effect the slabs or footings of the Turbine House over.

Intervention might include either temporary sealing off of seawater inflow and repair of concrete (refer section 4) or permanent sealing off of seawater.

Permanent sealing off should be given serious consideration because it may help to arrest further long-term deterioration and maintenance costs and would make future access, interpretation and maintenance easier.

6.5 FACADES

A major problem with facades on tall buildings is the potential for falling objects.

An object does not need to be large to cause injury or fatality if it falls from a significant height.

Objects smaller than an apple can be potentially harmful.

Where decorative facades occur the major problems are spalling stonework, spalling concrete or spalling render.

Other potential problems are loose cladding sheets and broken glazing.

Apart from ongoing monitoring all the facades require a detailed inspection and make safe operation from a "cherry-picker" hoist or similar access system.

This operation should use façade elevation drawings or photographs as reference documents to both record accurately the areas inspected and document defects.

The initial inspection should include tools necessary to remove or secure any material that has the potential to fall before the next inspection.

Sometimes removal can put at risk other fabric or watertightness however if an object has the potential to fall this should take priority.

Where removal requires follow up repair this should be noted on the relevant elevation record drawing and should be followed up as soon as is practical afterwards.

If for any reason material cannot safely be removed or access can not be made, the area below should be barricaded off with appropriate signage to prevent access until make safe can be carried out.

6.6 SEISMIC STABILITY

Although engineered buildings in Sydney well founded on rock are not considered high seismic risks the lessons of the 1989 Newcastle earthquake are that all buildings do have some risk elements.

In particular unsecured facades and parapets can be problems.

Current earthquake codes cover both new buildings and strengthening of existing buildings.

There are two conditions that require review.

6.6.1 The buildings and structures as they currently stand.

In this situation it would probably only be necessary to consider items such as:

- parapets
- areas of pure masonry construction (ie brickwork which is not restrained by steelwork or concrete frame)

- areas of attachment of masonry to steel or concrete frames (ie brick infill panels)
- areas of damage or alteration

6.6.2 The buildings subject to future use.

Future use has several effects:

- an increased risk profile: whereas currently the buildings have restricted public access and a very low occupancy future use is likely to have a substantially higher occupancy which could include people of restricted mobility.
- alterations to the structure that have the potential to weaken its lateral load capacity (eg cutting of openings into walls for windows and doors and into floors for stairs and atriums).
- alterations to the building that redistribute n increase its mass (particularly at high level) and consequently change its seismic response (eg installation of additional floors , water tanks, plantrooms).

These alterations would necessitate structural design in accordance with the relevant code.

6.7 STRUCTURAL CAPACITY

The buildings and structures are inherently robust bearing in mind their past industrial usage.

The buildings would have been well engineered and quality of construction would have been well supervised.

In addition the buildings were designed to carry heavy loads (coal, water and masses of cabling) which are no longer applied.

Consequently structural capacity is more likely to be constrained by condition rather than initial design.

Condition issues are generally fairly readily apparent. The possible exception being potential for corrosion of embedded structural steelwork within brick walls.

Consequently structural capacity in general could be expected to be high.

Certain future uses could however generate localised high loads which should be checked at the time.

Areas which should be subject to load check prior to future use proposals might include:

- Floor grates and access ladders – the floor grates associated with access walkways may not comply with current code requirements particularly with regard to access for tour groups and the like.
- Parapets under wind load and seismic load and in situations where required to act as balustrades.
- Handrails
- Curtain wall and large window mullions and transoms under wind load
- Roof planks in the boiler house which have already had additional dead load applied from new pavers.

When future uses are determined specific load checks will be necessary.

Such load checks might include capacity of existing columns and footings to sustain loads from the installation of new floors.

Geo-technical investigation would probably be required to confirm the nature and depth to bearing material beneath the site and the nature and depth of existing footings.

6.8 OPENING-UP WORKS AND TESTING

Precautionary investigations recommended in some areas.

Structural steelwork clad in masonry in external walls: Localised removal of masonry is recommended to check condition of ties between the masonry and the steelwork and the condition of the steelwork with regard to corrosion (eg north wall of Boiler House).

The site is subject to chlorides from the proximity of the harbour and the use of seawater for cooling and to sulphates from the burning of coal. Consequently there is a risk of corrosion to encased steelwork.

Precast roof panels: Localised sampling is recommended to determine the level of moisture and potential detrimental materials in the spalling roof planks.

Block wall east side of Turbine House South End: The nature of construction of this wall is not well understood. There may be the potential for corrosion of reinforcing within this wall which is now exposed to the elements.

There would also be information discovered to assist in determining if it is of technical interest.

Localised sampling to determine the level of moisture and potentially detrimental materials is recommended.

6.9 FIRE RATING OF STRUCTURE

Fire rating has not been assessed as part of this report but should be included in any adaptive re-use proposal.

Due to the nature of the major structural elements (ie steelwork), the major glazed elements and the compartment volumes it is considered that a BCA Deemed to Comply approach will not be appropriate and specific fire engineered solutions will be required for each adaptive re-use proposal.

7.0 ITEMS OF POTENTIAL ENGINEERING HERITAGE SIGNIFICANCE

The buildings on the site in general do not display any particularly unusual engineering techniques.

Whilst volumes are large, spans are either broken down by intermediate structure or by the linear nature of the buildings.

Brick clad steel frames, loadbearing brickwork, corrugated metal clad steelwork, reinforced concrete supported by steelwork and mass concrete are the predominant elements.

The facades are articulated and the parapets are decorated to provide aesthetic quality to the pre-1950s buildings on site.

There is an impressive 75 tonne capacity gantry crane in the turbine house, although this is more an item of equipment than structure and its support structure is conventional.

There are however certain elements worth particular mention.

The following items are considered to be of technical interest and potential heritage significance with regard to structural engineering.

7.1 THE PRE-CAST CONCRETE ROOF SLAB TO THE SOUTHERN HALF OF THE BOILER HOUSE

The more recent southern half of the boiler house was constructed in 1953. It is predominantly a steel framed masonry clad building with a flat roof.

The flat roof is constructed of extruded precast concrete planks laid over steel beams.

The construction details are obscured by later works, however it appears likely that a screed was laid over the pre-cast units, probably to a gentle fall and then a waterproof membrane laid over the screed.

This is in contrast to the northern half of the boiler house (and all the other roofs on site) which is a steel trussed pitched roof clad with corrugated metal sheeting.

The reason for selecting a flat roof is unknown since it is unlikely that height restriction was the reason. It is more likely that it was a decision based on architectural appearance.

It is apparent that the waterproofing failed. Whether this was due to poor waterproofing or due to defects in the substrate is unknown. It is often difficult to seal over pre-cast components because of cracking at pre-cast junctions.

The failed waterproofing has allowed moisture to penetrate which has led to corrosion in the reinforcing of the pre-cast units and consequent spalling of the units and also to corrosion of the underlying steelwork.

Repairs have been attempted which consist of laying paving units over the membrane and then sealing over the paving. Whilst this repair has achieved some success it is unlikely to be effective in the long term, since it still has the inherent defect of attempting to seal joints between discrete units (in this case the paving units).

Spalling is still occurring.

This form of construction, though not particularly successful, may represent an early use of extruded pre-cast concrete units for such an application.

Whilst of interest and worthy of recording it has not been a successful technique and would not be considered to be of such significance to warrant retention unless an effective waterproofing treatment can be identified and the extent of existing deterioration can be confirmed as insignificant.

We recommend that a section of roof be examined in detail (including removal of topping) and tested for chemical attack and condition prior to making long term conservation or demolition decisions. (Refer also to section 5.0 for monitoring requirements.)

7.2 METAL FRAMED WINDOWS AND CURTAIN WALLS

Throughout the site there are examples of large metal framed glazed windows and in the 1953 boiler house this has evolved into a curtain walling system to the east wall.

It is not known where these elements fit into the chronology of the use of metal framed windows and curtain walling, however this warrants either further investigation or the opinion of an architect with particular experience in this area.

7.3 REINFORCED BLOCKWORK TO THE EAST WALL OF THE TURBINE HOUSE

The east wall of the turbine house where it projects beyond the current line of the south end of the boiler house is constructed of reinforced core filled concrete blocks.

Whilst this wall has little aesthetic appeal (it appears as a rough and somewhat ugly façade that was never intended to be seen but is now visible due to the demolition of old boiler houses in front of it) it is nevertheless interesting.

The blocks are large and well beyond the proportions of current commercial blocks. It is likely that the blocks were made specifically for this project and that this walling system may also be site specific.

The age of this wall is unknown. If it is of the same age as the southern end of the turbine house (circa 1928) it is particularly interesting and may represent a very early use of reinforced concrete block construction.

Alternatively, it may date from the demolition of the boiler houses that were to the east of it and may have been constructed at that time to make good the exposed façade left by the boiler house removal.

7.4 THE MASSIVE STEEL SECTIONS SUPPORTING THE COAL HOPPERS

The coal hoppers, whilst being items of equipment, are also impressive pieces of structure.

The hoppers consist of massive all welded steel bins, which although stiffened by dividing walls are otherwise unbraced.

They are top hung and largely work as steel “bags” which predominantly carry load by tension in their steel skins.

Because they are top hung the steelwork supporting them necessarily has to be particularly high.

The large weight of the loaded bins coupled with the great height has necessitated massive steel sections.

These sections are unlikely to have been hot rolled.

In the northern section of the boiler house the sections are built up of riveted plates however the immediately adjacent southern section shows the more modern technology whereby the plates appear to be welded.

The welding is so neat and well finished that the sections appear to be in fact cast sections.

It is unlikely however that such large sections would be made from cast steel.

7.5 THE CHIMNEYS

The pair of chimneys are guyed steel clad cylinders some 76 metres high and supported by internal steel trussing (ie the steel cylinder is not the primary load bearing element).

The exhaust flues from the boiler house and the flues from the fans are missing but the openings indicated that they entered the stack at relatively high level (ie there are no underground flues entering the chimney base).

The chimneys are of impressive size and certainly add to both the landmark aspects of the site and its ready interpretations as a power station.

It is not known if the construction technique is unusual and this warrants further research.

7.6 STATEMENTS OF HERITAGE IMPACT

At this stage the technical significance of these items has not been fully assessed.

Until this is done any alterations to, or demolition of, the foregoing items should be subject to a Statement of Heritage Impact in accordance with NSW Heritage Manual guidelines.

8.0 NEW STRUCTURAL MATERIALS POLICY

8.1 REPLACEMENT MATERIALS

CONCRETE REPAIRS:

Cementitious and epoxy repair compounds will be permitted. All repairs should be colour matched to adjacent concrete substrate.

BRICKWORK:

Where cracked or damaged bricks are being repaired replacement bricks should match original as close as possible.

Where new brickworks is being inserted, either to fill in openings or to fill in where embedded steelwork has been removed, it should be of a uniform contrasting colour selected by an Architect.

Contrasting bricks used thus will allow interpretation of the alterations. The same brick should be used throughout the site for this purpose unless the Architect directs otherwise for specific aesthetic reasons.

MORTAR:

Where mortar repairs are required the mortar should match the original for both aesthetic and fabric preservation reasons.

Original mortar should be analysed to confirm its constituents and strength and new mortar should be batched to match original.

STEELWORK:

Steel repairs may be made using steel components which satisfy current codes and availability.

Corrosion protection should comply with AS/NZS 2312 although final colours should be selected by an Architect taking due account of the Conservation Management Plan.

TIMBER:

Replacement structural timber should be selected and treated for its required durability and exposure condition.

8.2 REPLACEMENT POLICY

Replacement materials should respect the original form and function of the replaced item and should be fixed in the same position.

Corrosion protection requirements may lead to variations in colour (eg use of galvanizing).

In certain circumstances for reasons of safety and durability alternative materials may be used (eg replacement of conveyor walkway floor with a steel structure).

9.0 APPENDIX A – 2010 PHOTOGRAPHS

Picture A1

Picture A2

Picture A3

Picture A4

Picture A5

Picture A6

Picture A7

Picture A8

Picture A9

Picture A10

Picture A11

Picture A12

Picture A13

Picture A14

Picture A15

Picture A16

Picture A17

Picture A18

Picture A19

Picture A20

Picture A21

Picture A22

Picture A23

Picture A24

Picture A25

Picture A26

Picture A27

Picture A28

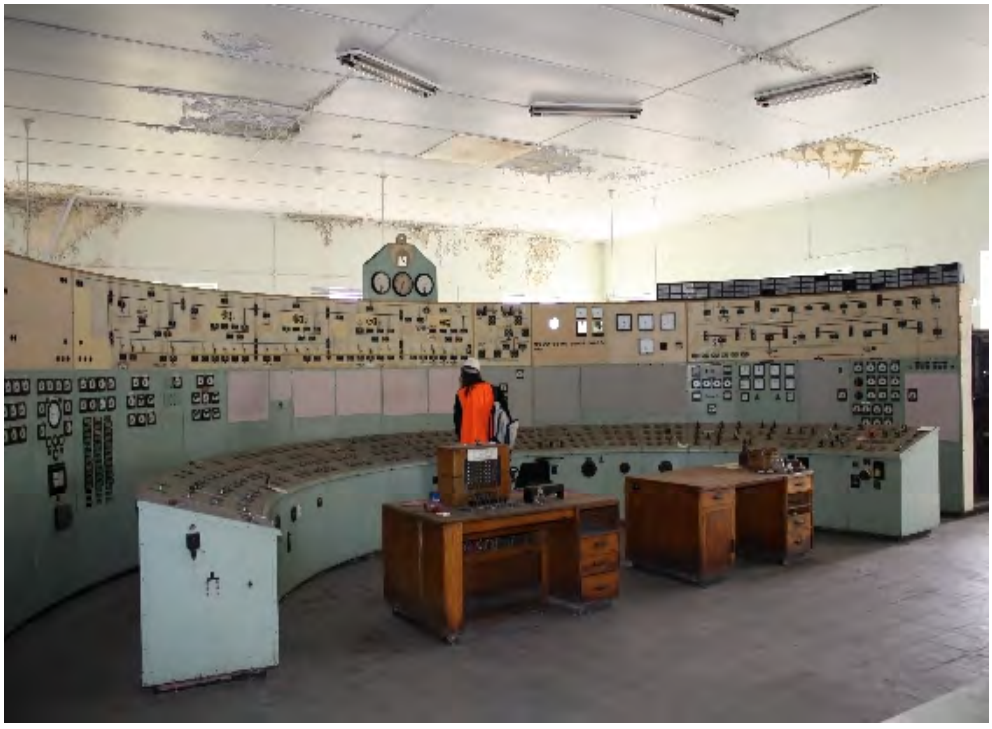
Picture A29

Picture A30

Picture A31

Picture A32

Picture A33



Picture A34

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Picture A88

Picture A89

Picture A90

Picture A91

Picture A92

Picture A93

Picture A94

Picture A95

Picture A96

Picture A97

Picture A98

2003 PHOTOGRAPHS

Photo B1

Photo B2

Photo B3

Photo B4

Photo B5

Photo B6

Photo B7

Photo B8

Photo B9

Photo B10

Photo B11

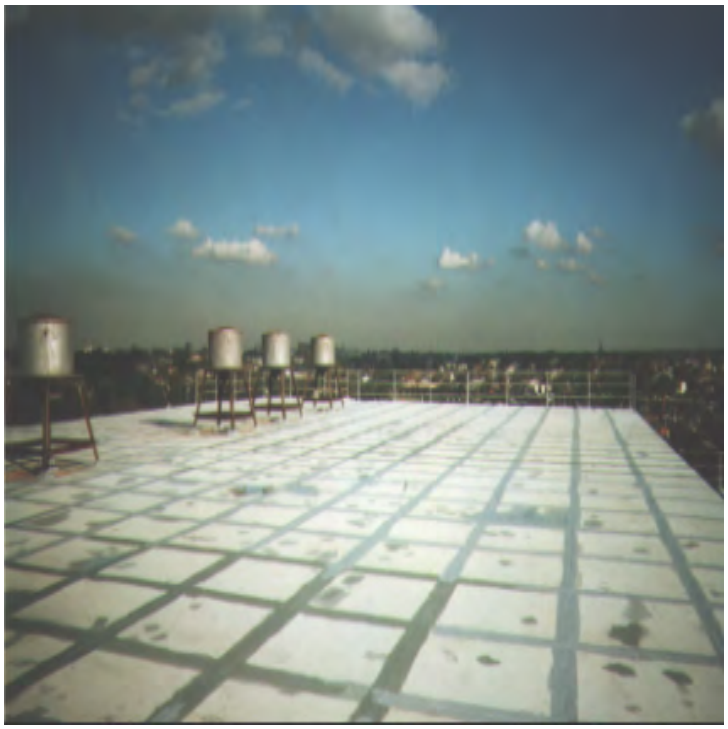

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Photo B13

Photo B14

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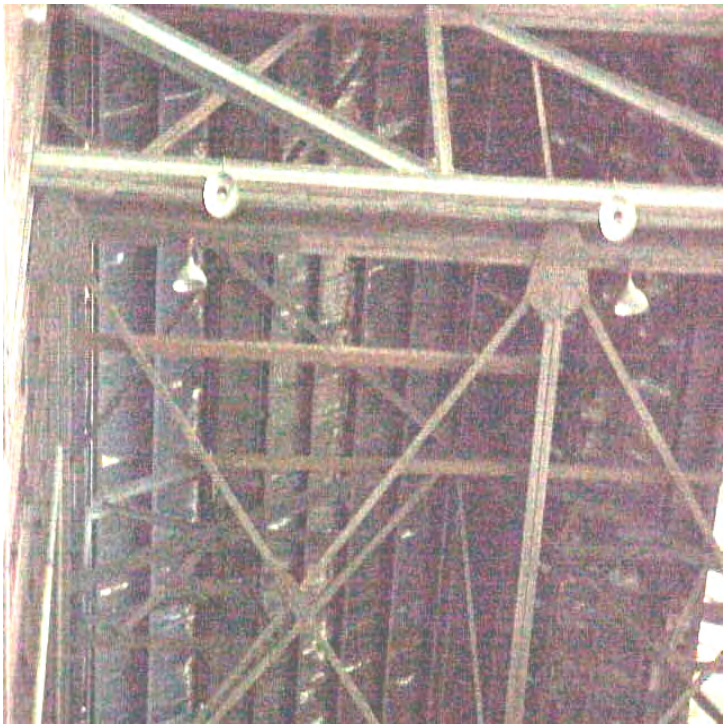

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Photo B19

Photo B20

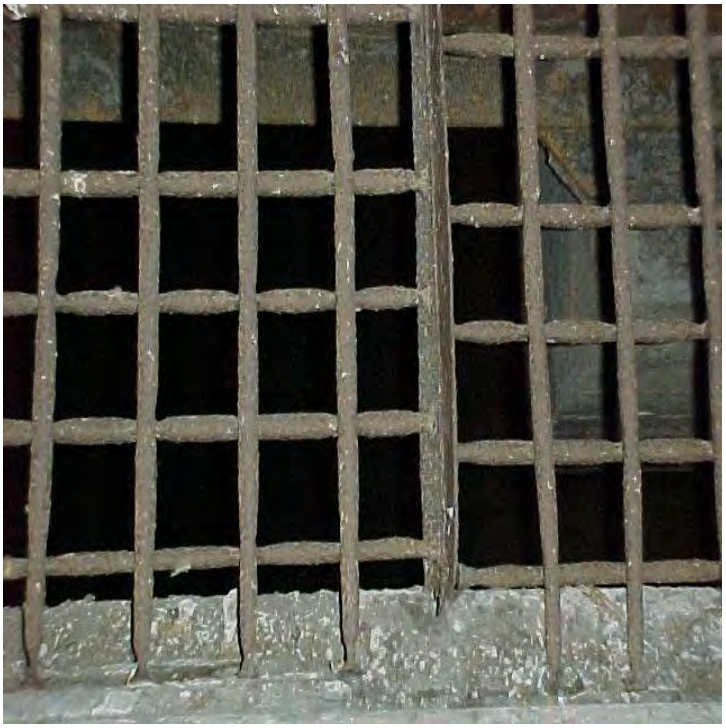
Photo B21

Photo B22

Photo B23

Photo B24

Photo B25



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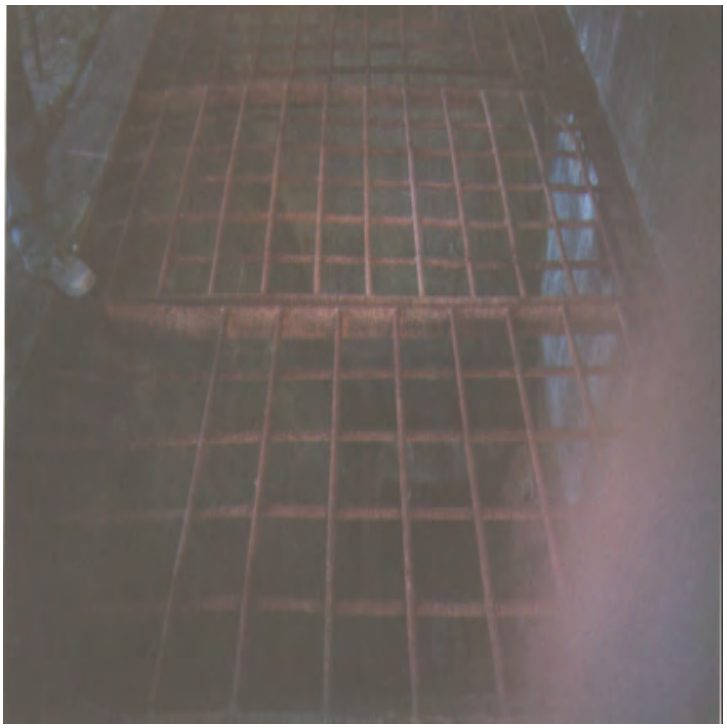

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Photo B30

Photo B31

Photo B32

Photo B33

Photo B34

Photo B35

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Photo B37

Photo B38

Photo B39

Photo B40

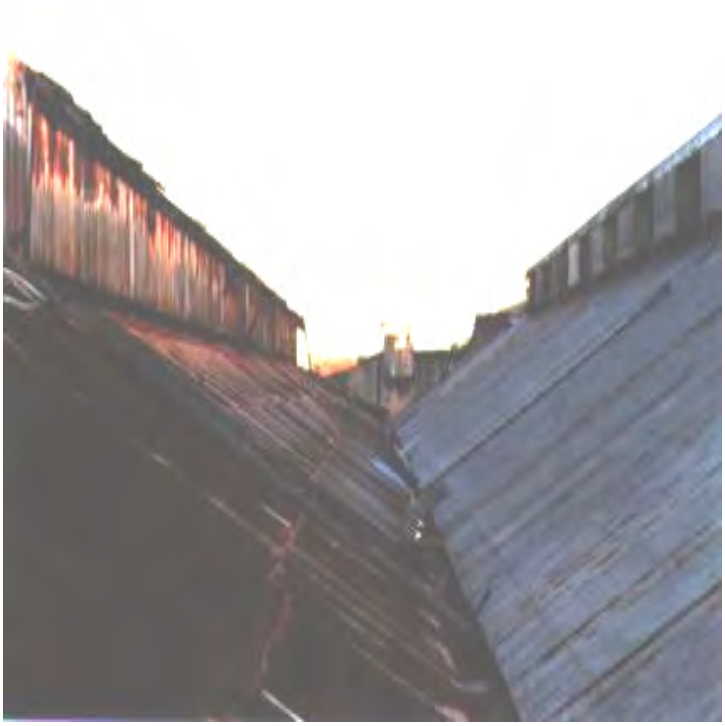

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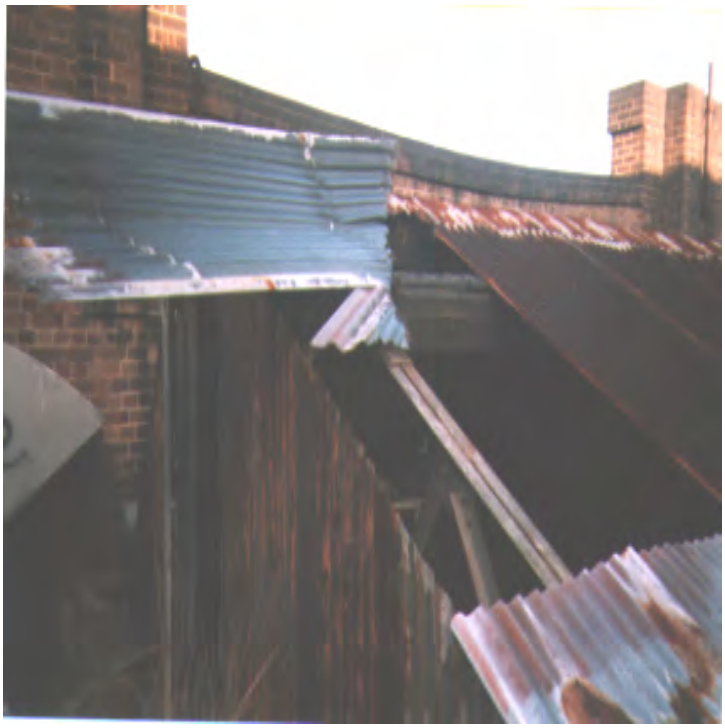
Photo B46

Photo B47

Photo B48

Photo B49



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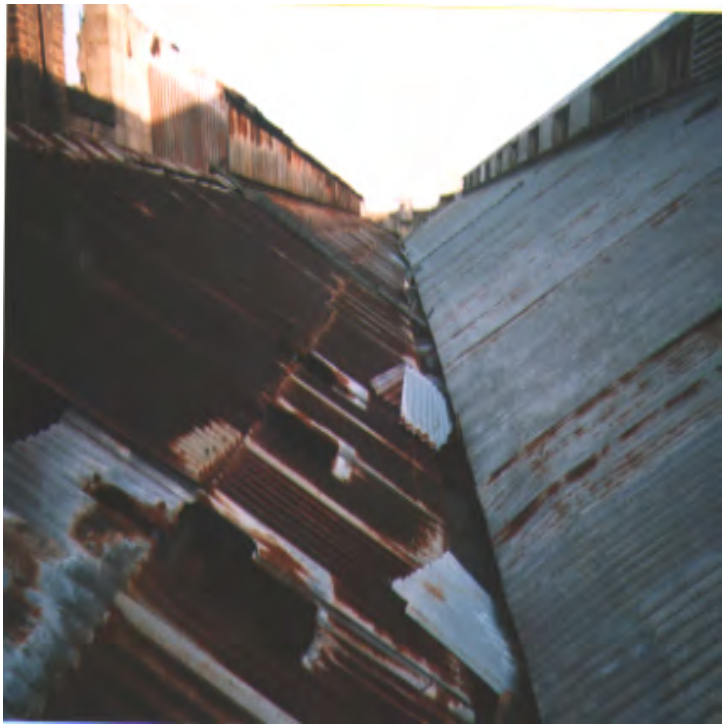

Photo B51

Photo B52

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Photo B64

Photo B65

Photo B66

Photo B67

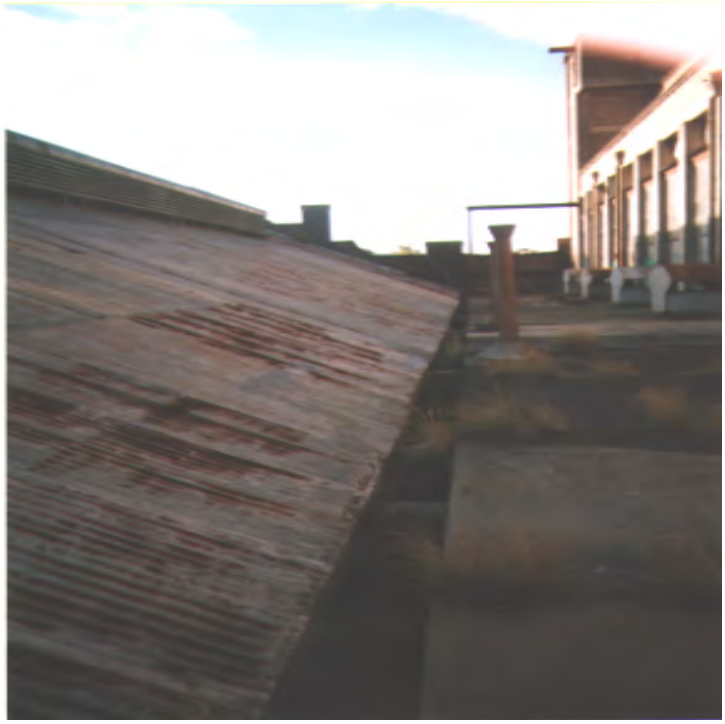

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Photo B101

Photo B102

Photo B103

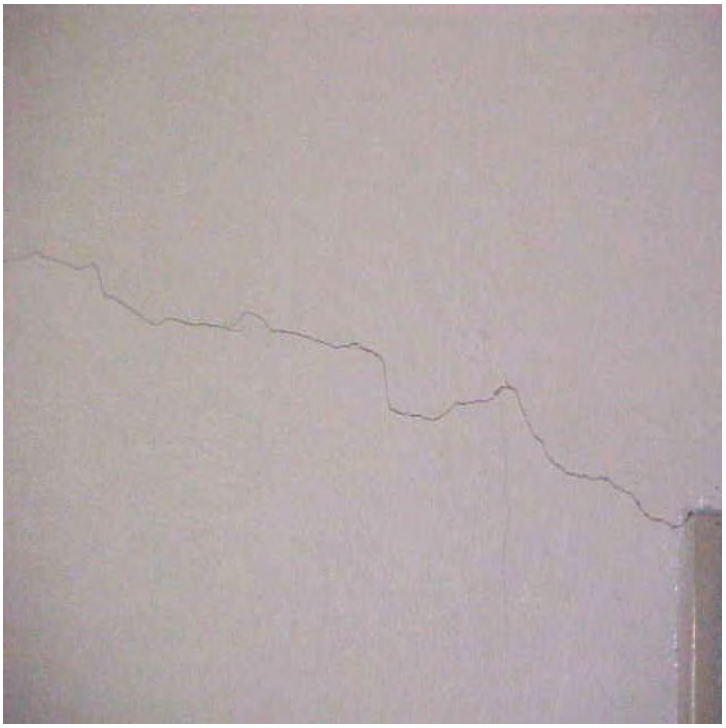


Photo B104

Photo B105

Photo B106

Photo B107

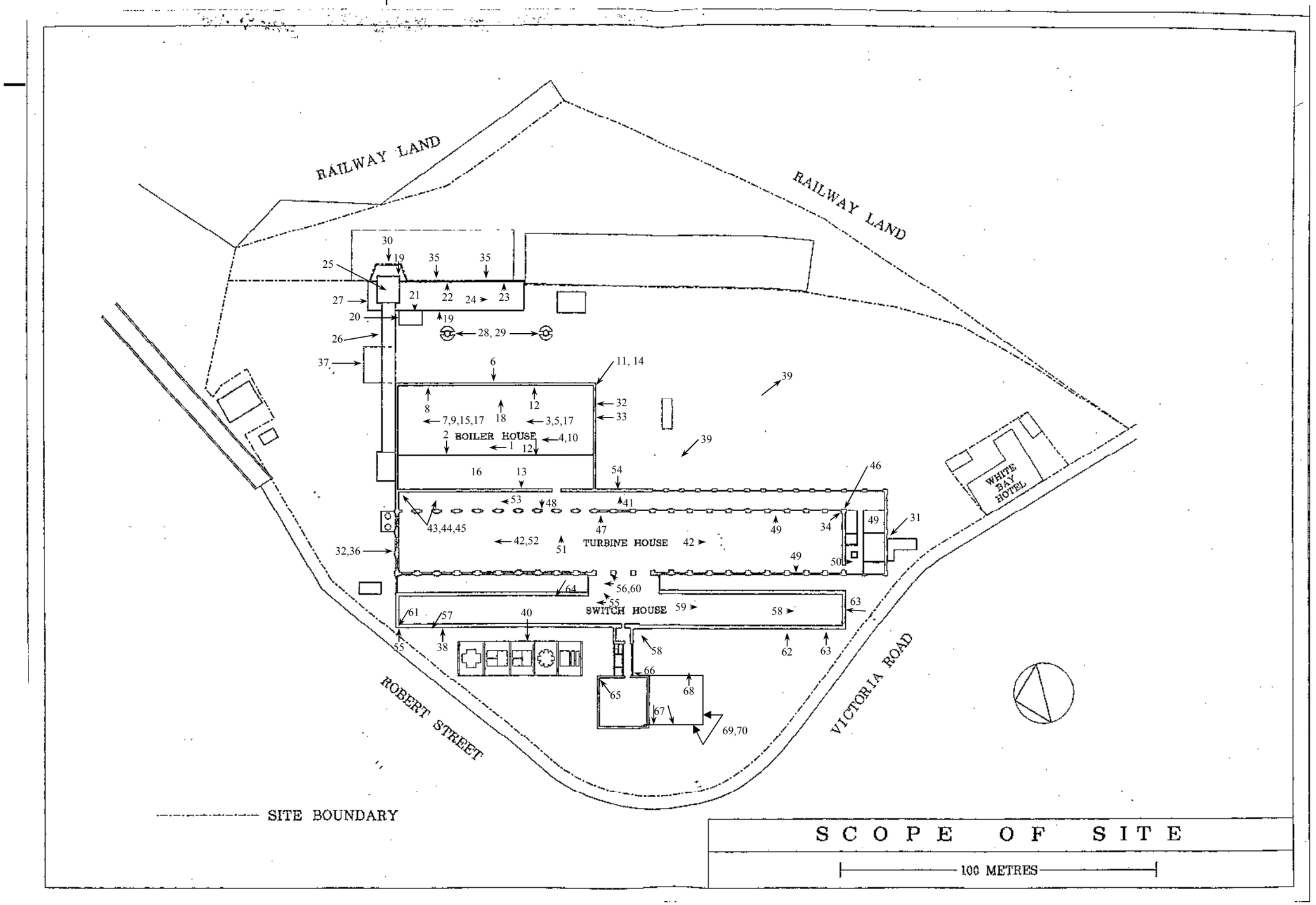
Photo B108

Photo B109

Photo B110

Photo B111

10.0 APPENDIX B – SITE MAP


RAILWAY LAND
RAILWAY LAND
BOILER HOUSE
TURBINE HOUSE
SWITCH HOUSE
WHITE BAY HOTEL
ROBERT STREET
VICTORIA ROAD
SITE BOUNDARY
SCOPE OF SITE
100 METRES