



Structural Report
for
Empire Bay Marine Structure
for Crown Lands

Revision Information

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Author:	Karlie Collis
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		Date
Prepared by	KC	18/11/2022
Checked by	NP	18/11/2022
Admin	KH	18/11/2022

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1.0. Introduction

1.1. Executive Summary

Northrop Consulting Engineers Pty. Ltd. ("Northrop") has developed this report in order to assess the existing condition of the boatshed, jetties, slipway and hardstand at 16B Sorrento Road, Empire Bay.

Two site inspections at the above-mentioned address were undertaken on Wednesday 17 August 2022 and Wednesday 24 August 2022, during fine weather conditions.

1.1.1. Inspector

- Karlie Collis BEng FIEAust NER CPEng Registered Professional Engineer NSW (CV attached)

1.2. Intent and Information

Northrop has been engaged by Department of Planning and Environment - Crown Lands as the engineering consultant to undertake a visual inspection of the existing boatshed, jetties, slipway, and hardstand at the site.

The purpose of the inspection and the subsequent report was to review the previous reports and existing condition of the structures and provide an opinion as to the structural adequacy and safety of the structures, including consideration of site remediation that is known to be required.

At the time of our inspection, we were in receipt of the following documents:

IPRA Building Condition Report Ref DOC20/034626 2nd April 2020

IPRA Site Survey and Building Condition Report Ref DOC20/034626 25th July 2022

Skelton Consulting Engineers Report Ref 20-075 1st April 2022

Douglas Partners Report Ref 202478.00 R.001.Rev1 28th July 2021

Partridge unsolicited structural report 2nd December 2021

SafeWork Improvement Notice ref 7-423151

Environmental Protection Authority (EPA) Declaration of significantly contaminated land, Declaration number 20211114 13th May 2022

Refer to **Section 2** of this Report for site information and location.

Refer to **Section 3** of this Report for general photographs of the site and subject affected areas.

Refer to **Section 4** of this Report for observations and discussion on the noted structural issues.

Refer to **Section 5** of this Report for recommendations.

2.0. Information & Location

2.1. Site Information & Location

Site Name:	Former Empire Bay Marina
Site Address:	16B Sorrento Rd, Empire Bay
Northrop Project Number:	NL221807
Date of Inspections:	17 August 2022 and 24 August 2022

2.2. Site Map

The site is located adjacent to the council foreshore, just North of the Empire Bay Wharf. The structures consist of 2 jetties (one southernmost attached to the boatshed, referred to in this report as “attached jetty” and one northernmost “unattached” jetty), a boat shed and associated slipway and concrete hardstand.



Figure 1 - Aerial view of the site (Source: GoogleEarth)

3.0. General Photographs

The following photographs provide general views of the site as well as specific issues discussed further in this Report:



Figure 2 - Jetty attached to boatshed



Figure 3 - Water-side of boatshed



Figure 4 - Unattached northernmost jetty



Figure 5 - Unattached northernmost jetty where section loss of piles can be seen just above water level.



Figure 6 – Rot to timber pile in attached jetty



Figure 7 - Attached jetty with missing decking boards, obvious displacement and deteriorated timber members



Figure 8 - Pile to attached jetty showing loss of section



Figure 9 - Pile to attached jetty with section loss at water level



Figure 10 - Attached jetty with missing decking boards, displacement and deteriorated timber members



Figure 11 - Subfloor structure with ratchet straps, ropes, carjacks and loose packing used in previous remediation attempts



Figure 12 – Failed bearer in subfloor, resulting in structurally unsound support to structure over



Figure 13 - Subfloor structure with car-jack, deteriorated timber packer and failed bearer (to right)



Figure 14 - Subfloor structure with rotated bearer and deteriorated timbers



Figure 15 - Subfloor structure including car jack, packing and deteriorated timber members



Figure 16 - Bearer unsupported at end, resulting in unsupported structure over



Figure 17 - Failed floor joist and bearer



Figure 18 - Failed bearer, apparent shear failure near support



Figure 19 – Displaced, deteriorated timber pile packer



Figure 20 - Failed floor joist



Figure 21 - Base of wall frame showing section loss



Figure 22 - Timber member strapped to underside of failed bearer



Figure 23 – Deteriorated bearers and joists over split and deteriorated timber pile



Figure 24 - Floor joists and bearer, deteriorated with section loss



Figure 25 – Deteriorated floor joist with section loss



Figure 26 – Deteriorated floor joist with section loss



Figure 27 - Bearer showing signs of failure to the left of previous repairs with displaced and deteriorated pile under



Figure 28 - Failed bearer resulting in unsupported structure over



Figure 29 - Car jack providing support to bearer



Figure 30 - Pile support failing below packing member resulting in unsupported structure over



Figure 31 – Deteriorated and displaced subfloor timber adjacent to hardstand area



Figure 32 - Hardstand area – note tank access to right of photo and steel slipway beyond



Figure 33 - Steel slipway rails



Figure 34 - External north-western corner of the boatshed showing deterioration of timbers



Figure 35 - Corrosion to roof sheet and failed timber roof member (South-eastern corner)



Figure 36 - Eastern external boatshed with deteriorated timber cladding, some missing and warped flooring due to substructure failure



Figure 37 - Eastern deck and base of external wall of boatshed showing deteriorated timber



Figure 38 - North-eastern external corner of boatshed showing deteriorated timber cladding



Figure 39 - External south-eastern corner of boatshed showing plywood patching to both decking and wall framing. Obvious distortion of wall alignment noted.



Figure 40 - Western elevation of boatshed. Note staining to oil sump area. Slab in foreground over underground tanks.



Figure 41 - Junction between hardstand and suspended deck showing deteriorated, unsupported timbers



Figure 42 - Mezzanine of boatshed



Figure 43 - Internal boatshed (eastern wall)



Figure 44 - Internal boatshed (northern wall)



Figure 45 - Internal showing structural arrangement of mezzanine support



Figure 46 - Termite damage (internal boatshed), noting section loss



Figure 47 - Termite damage to lining boards (internal boatshed)

4.0. Observations and Discussion

My findings are outlined below. Note that I generally agree with the findings and conclusions in the referenced reports from IPRA and Skelton.

4.1. Attached Jetty

The attached jetty is shown in Figures 2, 3 and 6-10. The jetty showed evidence of settlement/displacement of timber piles. The length of jetty parallel to the shoreline was in a highly dilapidated state with floorboards missing and horizontal displacement of the piles. Timber piles also showed a reduction in cross-sectional area just below water level (refer Figures 8 and 9). Timber pile softening was noted to the inside face of the pile as shown in Figure 6 where timber was easily removed by hand. Figure 48 below shows the measured change in levels of the structures between 2020 and 2022. Note that the jetty has been largely unused during this time and as such has been subject to minimal imposed loads apart from wave action and tidal effects. Even so, the jetty has experienced between 18mm and 62mm of vertical displacement which, in my opinion, suggests inadequate pile bearing materials or failure of the pile itself.

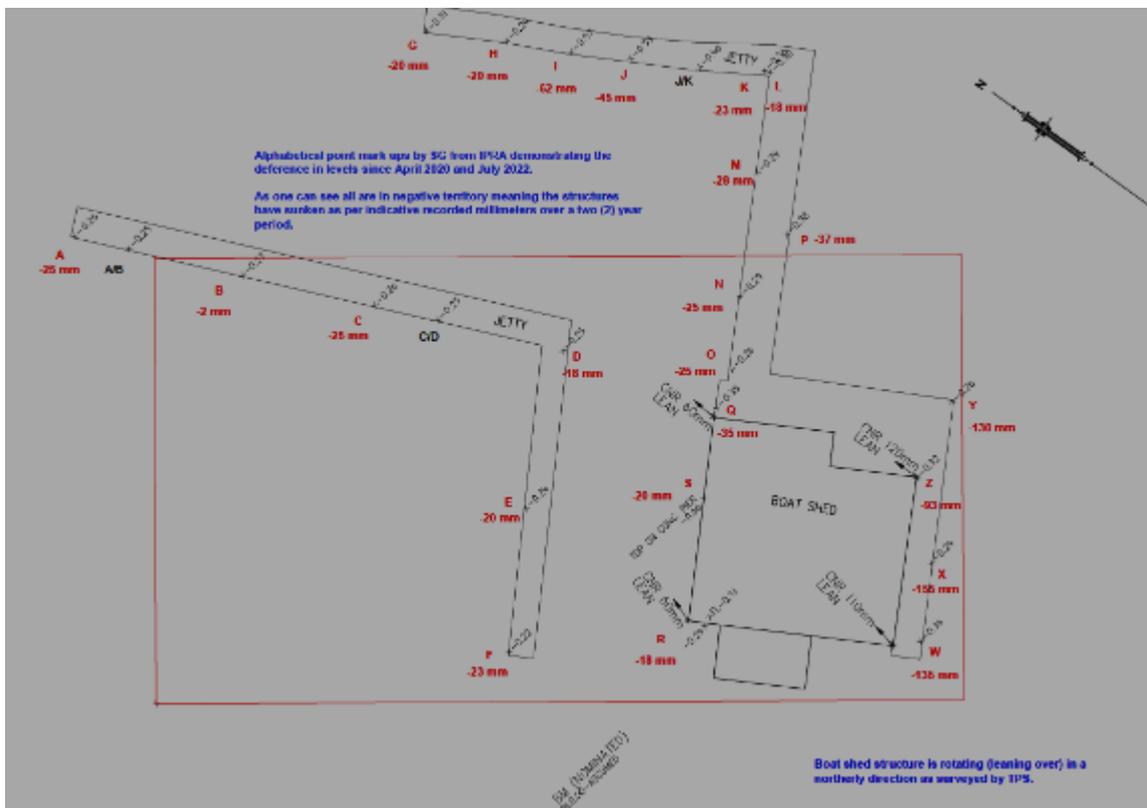


Figure 48 - Level changes recorded between 2020 to 2022 (IPRA report 25.07.22)

4.2. Unattached Jetty

The unattached jetty appeared to have suffered less displacement, although piles were noted to have suffered section loss just below water level (refer Figure 5).

4.3. Boatshed Subfloor and Floor Structure

Figures 11-31 show the condition of the subfloor structure of the boatshed. The subfloor framing exhibited several structural issues including inadequate, ad-hoc repair attempts using ratchet straps, car jacks and various packing measures.

Many timber bearers and joists showed signs of failure in bending and/or section loss. Those with cracking to the tension face (midspan in bottom and in the top over supports) have failed in bending. Examples can be seen in Figures 12, 17, 20, 27 and 28. Others have failed due to material deterioration such as those shown in Figures 22, 23, 24, 25 and 26.

A number of bearers appeared largely unsupported (refer Figures 14 and 16). Other bearers had ad-hoc support using car jacks (noted to be corroded) and corroded fasteners.

Where members have failed and or are unsupported, the floor system is, in my opinion, not structurally sound and unable to support imposed loads.

Piles were constructed of timber, some with PVC pipe surrounds, some concrete filled. Failed piles supporting the structure are shown in Figures 11, 13, 15, 18, 19, 23, 27, 29 and 30. Much of the subfloor floor framing was packed by various means with no fasteners or tie-down noted between the packing elements. Vertical subsidence experienced between 2020 and 2022 (refer Figure 48) is significant in magnitude. It suggests that, in my opinion, inadequate pile bearing materials or failure of the piles themselves.

4.4. Boatshed Structure

The Boatshed structure consisted of timber framing with timber cladding and a metal sheet roof over. Much of the interior of the boatshed was lined and as such unable to be inspected. Damage from termites was noted in 2 locations, although the extent was unable to be verified due to wall and ceiling linings.

External cladding to the boatshed consisted of mostly horizontal weatherboards, but with sheeting to some areas, installed in an ad hoc fashion, likely, in my opinion, as an attempt to reinstate weatherproofing following cladding failure. Many areas of cladding were deteriorated, damaged or missing. We understand the cladding has been noted to have lead paint (which was flaking and peeling).

As expected, externally exposed timber framing (often due to damaged cladding) was decayed and weathered (refer Figures 34 and 37).

The internal flooring consisted of plywood lining over timber boards. According to the Skelton report, it is proposed that internal contaminated flooring is removed due to contamination.

The junction between the hardstand and the suspended floor structure (Figure 41) shows the slab having been undermined as supporting soils have been displaced.

The structural members supporting the mezzanine appeared grossly inadequate in size to support mezzanine floor loads. Linings to the mezzanine prevented visual inspection of the underlying structure, including inspection for termite damage.

Timber members able to be inspected internally appeared to be in fair condition (except those with termite damage noted below) with generally no signs of structural distress to the members themselves, although framing had obvious distortions (characterized in the surveyed results).

Termite damage was noted to 2 areas (refer Figures 46 and 47) although the extent of damage was unable to be verified due to the presence of wall linings.

4.5. Hardstand Area and Boat Slipway:

The concrete hardstand was noted to be cracked and damaged in many areas (refer Figures 32 and 33). It is understood fuel tanks located beneath the slab are subject to an Improvement Notice from SafeWork NSW, requiring the removal of underground tanks and associated equipment by 18th November 2022; however, we understand SafeWork has extended this timeframe until 1st August 2023.

The concrete slipway was also cracked with some corrosion to the rails over.

I understand that there are 2 or more fuel tanks beneath the hardstand area, which are subject to a remove and remediate order from the NSW Environment Protection Authority. I also understand that the site has been declared "Significantly Contaminated" by the NSW EPA and is under regulation under the Contaminated Land Management Act 1997. It has been estimated that the tanks are approximately 5000L in size and approximately two metres in depth. It is understood the removal and remediation process requires testing and further removal of contaminated materials around the tanks.

The client indicated that a contaminated soil sample was taken immediately beside the boatshed. Given this result, and the size of the adjacent tanks, it is clear that excavation adjacent to the boatshed will be of a depth that will undermine the western end of the boatshed. It is a possibility that the contamination extends further beneath the boatshed, which, if discovered, would require further removal of soils and have greater impact on the building footings

5.0. Recommendations

Following my inspections and review, I am of the opinion that the boatshed subfloor structure is in a dilapidated and structurally unsound state and is at risk of collapse due to adverse weather events or vertical loading of the floor. I recommend that access to the boatshed and surrounds is strictly prohibited for safety reasons.

Due to the condition of the subfloor and flooring structure, I am of the opinion that removal of the sheet flooring will be difficult to be do in a safe manner.

The removal of underground tanks at the site would involve the destabilization of the soils around the tanks. In my opinion, based on the likely angle of repose of the saturated sandy soils, removal of the contaminated soil would undermine the boatshed structure. Further undermining would occur in the event that additional testing identifies further contaminated soils that require further soil removal. Given the tanks had been drained and yet contained a liquid at the time of our inspection, it is likely they have been leaking for some time, it would therefore be likely that further soil removal and remediation will be required.

Although I am not a Quantity Surveyor, in my opinion the cost to undertake these works would be significant and carries with it considerable safety risks including remediating the floor structure, which is currently unstable.

The jetties have, in my opinion, suffered settlement and displacement issues most likely due to inadequate pile depth. Existing piles are considered structurally inadequate due to the decay and loss of section at water level. Both jetties have in my opinion passed their service life.