

HMVS CERBERUS – Documentation in support of an application for a Heritage Permit to undertake structural reinforcement works

1. Introduction

This document is offered in support of an application to Heritage Victoria by Bayside City Council for a Heritage Permit under the *Heritage Act 1995* for conservation works to the wreck of *HMVS Cerberus* located in Half Moon Bay, Victoria.

2. Background

The HMVS Cerberus Conservation Management Plan (CMP) prepared by Ross Anderson of Heritage Victoria's Maritime Heritage Unit (MHU) during 2002 (Anderson 2002) included a most comprehensive statement of the cultural heritage significance of the remains of *HMVS Cerberus*. Significance was addressed on international, national, state and local scales. Consideration was given to the historical, aesthetic, archaeological, technical, scientific and recreational values of this uniquely surviving precursor of the modern battleship (see also Brown, 1992:80, Gillett 1982, Gillett and Graham 1977, Cahill et al. 1983, Herd 1986). Anderson's document also discussed the value of the wreck of *Cerberus* in terms of its ability to illuminate aspects of the past social and cultural life of Victorians, together with its power to provide contextual links to related sites important to defence, maritime and naval histories.

It is now more than forty-five years since the formation of the *Cerberus* Preservation Trust later to become the Maritime Trust of Australia. Early aims of the Preservation Trust to salvage the *Cerberus* by refloating the vessel and moving it to a permanent dry berth were frustrated by the problems of structural strength compromised as a result of corrosion in the buoyant hull, together with failure to raise the necessary funds. These issues did not daunt the enthusiasm felt by interested members of the public towards conservation in some form for this extraordinarily important shipwreck. Nevertheless, continuing corrosion and structural deterioration in the intervening time has narrowed the options while the challenges and costs have escalated.

In 1993 and 1994, wave energy during intense storm activity caused catastrophic collapses of the corroded buoyant hull structure under the influence of the great weight of the armoured hull, breastwork, decks and turrets (**Figure 1**). Although the upper deck is now awash at high water, the essential shape and profile of the vessel at present remains intact. However, as is stressed by Anderson, the next catastrophic collapse of *Cerberus* is predicted to entail the breaking up of the deck as the unsupported weight of the armour hinges the remaining structure out of alignment. GHD's structural analysis, based upon the corrosion rates developed by MacLeod in 1994, indicated that stress levels in the deck beams are approaching four times the safe working capacity (GHD 2003:i). Splitting of the sternpost, observed during an MHU inspection in 1999, was regarded as a forewarning of this final stage. A recent diving inspection undertaken by Malcolm Venturoni of Professional Diving Services has reported that a 20 metres length of the bow structure is now entirely devoid of structural support (M.Venturoni pers. comm. 17th October 2017). As the armour is segmental and bolted to relatively lightweight substructures, collapse is likely to result ultimately in loss of integrity and the vessel's present visual coherence. An engineering assessment places the likelihood of hull failure and collapse in the near future in the

absence of effective conservation measures as “a certainty” (GHD 2003:29) and notes the possible cost of removal of the resultant wreckage (should this be necessary to manage public risk and visual amenity) as being of the order of ten million dollars.

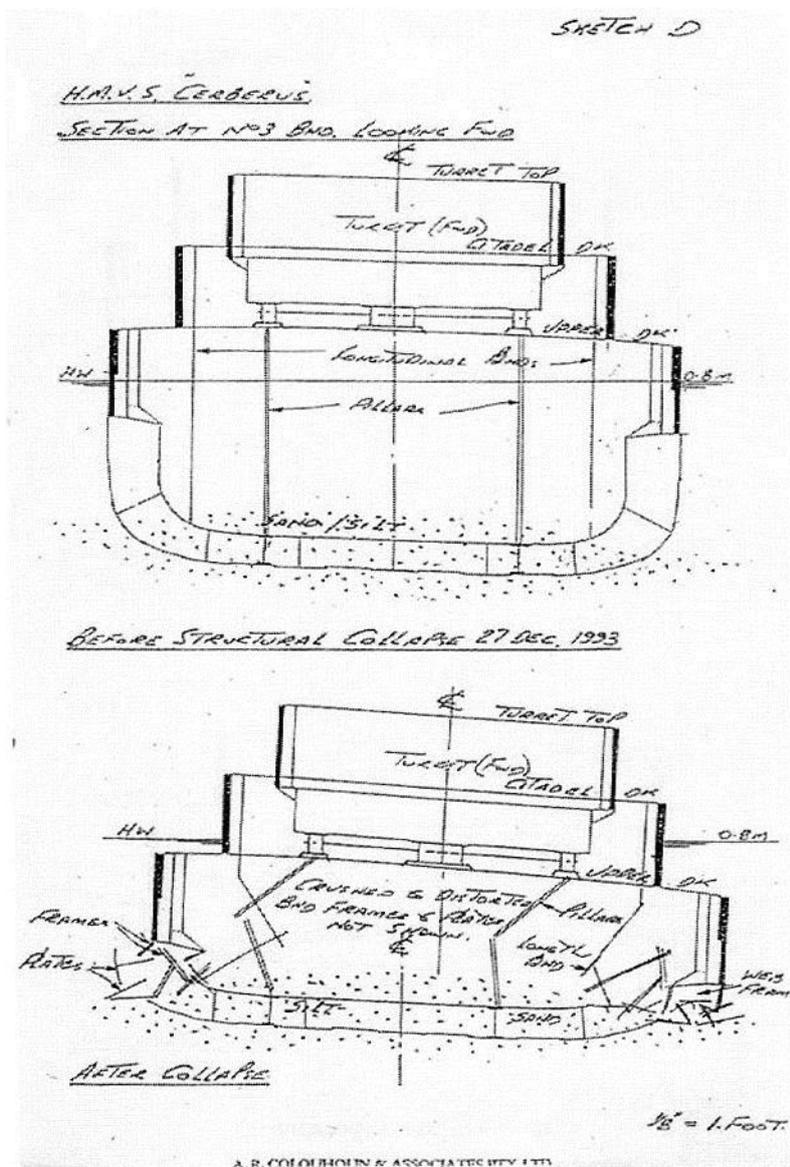


Figure 1 A section at number three bulkhead before and after the 1993 collapse (source: sketch by A.B. Colquhoun reproduced in Anderson 2002)

The collapse of *Cerberus* in the early 1990s and the increasing risk of total loss with passing time, has led to energetic lobbying by individuals and members of several community-based organisations, supported and encouraged by an expert international body of maritime archaeologists, historians and conservators. The very active and effective community-based group Friends of the *Cerberus* Inc. has been able, through effective lobbying, to obtain substantial funding from the Commonwealth for conservation work. This funding now totalling \$580,000, forms the core budget for the present proposal.

Post-collapse, the MHU has been active in data gathering. Outcomes are the *HMVS Cerberus* Archive Directory (Effenberger 1995), corrosion and ultra-sound surveys (MacLeod 1994, 1999), also appraisals of cathodic protection options (MacLeod 1999, Hewitt 1999, Solomons 1999). Under the leadership of Shirley Strachan, the MHU organised a *Cerberus* Project Team (Strachan 1995) which resulted in production of the CMP (Anderson 2002). Naval architects A.R. Colquhoun and Associates, who had been involved with attempts to salvage *Cerberus* since 1971, also conducted and reported on a diving survey subsequent to the 1993 collapse (Colquhoun 1993).

More recently, DSTO Maritime Platforms Division conducted an ROV-based survey on *Cerberus* for Bayside City Council. The aims of this work included recording video imagery of the structural support beneath the turrets, ultrasonic measurement of thickness of supporting beams, assessment of debris within the hull, a general external survey, a general environmental assessment and remote corrosion potential measurement. Bad weather curtailed the allocated time on site and difficulty was experienced with deploying the ROV due to sand encroachment and debris. The ROV survey, however confirmed the intactness of the armour belt and the existence of a break in one of the transverse beams beneath the after turret. Otherwise, these beams were coated with marine concretion but evidently intact. Remote ultrasonic thickness measurement on the internal structure proved inconclusive, but external corrosion potential measurements indicated that at the time of survey, the cathodic protection grounded system was reasonably effective (Neill *et al.* 2012).

The latest ROV survey by Professional Diving Services conducted 22nd September this year, found that the hull remains are sound and that no breaks or cracks were present in the armour belt, breastwork or decks. A minor subsidence was, however, noted in the forward turret. The majority of the internal spaces were found to be accessible for inspection. The vessel now lies with a 9 degree list to starboard and the lower edge of the armour belt on the starboard side is buried 200 to 300 mm in silt except for a distance of 20 m aft from the bow and 10 m forward from the stern. On the port side, the majority of the length of the armour belt is exposed with a gap between its bottom edge and the seabed of 200 to 400 mm over a 45 m length. Alarming, all mesh barricades fitted to deck penetrations were found to have failed. The majority of the internal subdivision and support has either collapsed or corroded away and apart from the underdeck structure supporting the turrets, there is little support for the hull sides and deck (Venturoni 2017).

3. Previous conservation approaches and proposals

From May 2000, Heritage Victoria engaged consulting engineers Gutteridge Haskins and Davey (GHD) who devised a methodology that first required the cutting away of the remnant buoyant hull structure then introduction of a supporting framework within the hull and breastwork. Following this, long supporting beams were to be placed abeam under the armoured sheer strake. The entire structure would then be jacked up to the pre-collapse level from an array of piles driven into the seabed adjacent to the wreck. Support for the structure would then be effected by permanent connection to the pile array (GHD 2000). The results of further investigations that included a diving inspection, trial drilling of holes into the armour and geotechnical boreholes into the seabed were reported by GHD during March 2003. Unfortunately, this methodology, which was potentially successful although not without risk, proved to be very expensive. Costs were estimated at \$3.7M plus \$1.5M for a

cofferdam necessary to avoid in-water heavy engineering work. Adequate funding could not be found and the proposal was abandoned.

An alternative approach that had been canvassed by the *HMVS Cerberus* Advisory Committee was to dismantle the wreck and barge it to shore where it might be reassembled and restored. As the cost of carrying out such a project was felt to be around tenfold the cost of in situ jacking and piling, it was not regarded as viable.

One management strategy put forward with the aim of delaying collapse was removal of the turrets and guns to lighten the load supported by what remains of the buoyant hull structure. Although the armoured Coles turrets remain in place, the four 10 inch 18 ton RML guns have indeed been removed as recommended by GHD (2003:32) and are presently lying on the seabed to seaward of the wreck cathodically protected by a groundbed system of galvanic anodes.

Conservation methods for *Cerberus* suggested in the past have included infilling of the hull and breastwork with the aim of supporting the weight of armour and turrets. Soon after the 1994 collapse, the *HMVS Cerberus* Advisory Committee proposed filling of the hull by pumping in dredged sand and employing rock beaching to retain the fill. Filling the internal void with broken stone consolidated with grout under pressure has also been considered and rejected on cost and practicability (M.Venturoni pers. Comm. 17th October 2017). The use of mass concrete and polyurethane foam as filling and supporting materials has been proposed in the past but these materials have not found favour due to non-reversibility and a combination of high installation cost, together with environmental hazards, in the case of polyurethane foam. Other proposals have involved constructing a cofferdam around the wreck and the creation of an island by placement of rock beaching. Each of these possible approaches has been considered and all have been rejected on the grounds of likely cost, practicability, long-term effectiveness, lack of reversibility and environmental impact.

4. The present proposal

Past rejection notwithstanding, the present Permit application is in respect of a proposal to install a permanent supporting core of monolithic concrete within the hull and breastwork of *Cerberus* as a means of supporting the mass of the armour belt, breastwork, turrets and decks. This approach has been adopted as a means of securing and conserving *Cerberus* by supporting the wreck remains and preventing further collapse. Filling the internal spaces of the wreck with concrete and continuing a regime of galvanic cathodic protection for the immersed exterior is considered to offer a multi-generational guarantee that the familiar profile and presence of *Cerberus* in Half Moon Bay can continue.

Importantly, infilling will also mitigate the public safety risk that the shipwreck currently presents. During 2010, a snorkeller died within the confines of the wreck, despite an exclusion zone, warnings and serious attempts at preventing access through deck openings. Infilling will prevent such tragedies in the future.

Although the use of concrete for supporting infill compromises two principles of the Burra Charter, firstly that conservation should not impact upon the cultural significance, and secondly, that changes that "...reduce cultural significance should be reversible, and be reversed when circumstances permit" (Walker and Marquis-Kyle 2004:54). Although it might be argued that concrete infill could be removed if necessary, it would represent a dauntingly

difficult and expensive task. Walker and Marquis-Kyle in their commentary on the Charter do however appear to offer a lifeline to *Cerberus* in the statement that “..Non reversible changes should only be used as a last resort...” (2004:54). The very real threat of imminent collapse, together with the failure to find a viable alternative conservation method, underscores an argument that it is time to adopt a last resort. Cost estimates have shown that within a small stretch of the available budget, we are indeed now able to effectively stabilise and preserve *Cerberus* (Venturoni 2017).

This may be the last opportunity we have.

5. Outline methodology

Venturoni (2017) has placed great emphasis on constructability. The key attribute of a viable methodology is one that allows the installation of a supporting medium to meet structural and durability requirements at a price point dictated by budget. The method must also be safe for personnel involved in the process and at the same time be free from environmental risk. One extremely important consideration driving the selection of a methodology, determined by the precariousness of the vessel, is that no penetration within the internal spaces by divers can be scheduled. Important too for assuring a positive public perception of the project and maintaining control of budget is the need to minimise potential delays. These considerations have led Professional Diving Services to review the possible use of both land and marine-based platforms for infilling works with a particular view to the impact on budget of weather-related delay. The methods required for retaining the filling material, cost and the likely environmental consequences of spillage were also necessary considerations in the selection of concrete as the filling material from a range of possibilities that included cement-stabilised sand and polyurethane foam.

The concrete will be pumped to the vessel from a temporary works compound in the carpark on shore via a 4 inch rigid delivery pipeline placed across the seabed between the wrecksite and the inshore reef. The rigid pipeline avoids danger to navigation and waterway users. A flexible rubber pipeline will be used to connect the concrete pump across the inshore reef to the rigid delivery pipe, which will avoid damage to the reef. A further rubber delivery pipe will connect to the seaward end of the rigid pipeline to allow concrete to be distributed within the wreck.

Deep penetrations on the main and upper decks will be blanked off with timber shuttering and progressively removed according to infill level. This will ensure that the hull will be filled to the level of all penetrations and limit spillage from within the hull during placement. The open spaces at seabed level on the port side, at the bow and stern, together with some 20 metres length of gap below the armour belt on the starboard bow, will be blanked off and a geofabric skirt will be secured against the hull with sandbagged walls during infilling (**Figure 2**). Debris from the wreck surrounding the hull that may be hazardous to divers working adjacent to the vessel will be relocated nearby for site safety.

The geofabric will extend to form a silt curtain around the site to prevent concrete or concrete slurry from spillage into the immediate environment. A staged pour approach will be employed to avoid excessive pressure within the structure and to prevent the blanking and containment arrangement from becoming overextended. A staged pour strategy also limits the passage of concrete trucks to reasonable daylight working hours and allows for the

inevitable periods of bad weather without a severe impact on budget. During placement of concrete, slurry and displaced water will be pumped from within the hull and delivered to a containment within a geobag placed alongside on the seabed for subsequent removal.

It is anticipated that site preparation will take ten days and pumping for placement of a maximum of 1,700 cubic metres of 32 MPa concrete will require a further twelve days. This will be followed by some five days of dismantling and demobilisation.

All underwater work is to be performed by an occupational dive team with qualified supervision, all in accordance with AS/NZS2299.1.2015.

If time and budgetary considerations permit, it is intended that the four ten-inch 18 ton RML guns removed from Cerberus and placed to seaward of the wreck would be moved to a location close to the wreck on the inshore side and the galvanic cathodic protection arrangement reinstated. The aim of this movement is to enhance the experience of snorkelers and swimmers visiting *Cerberus* when the need for a protected exclusion zone is removed following infill.

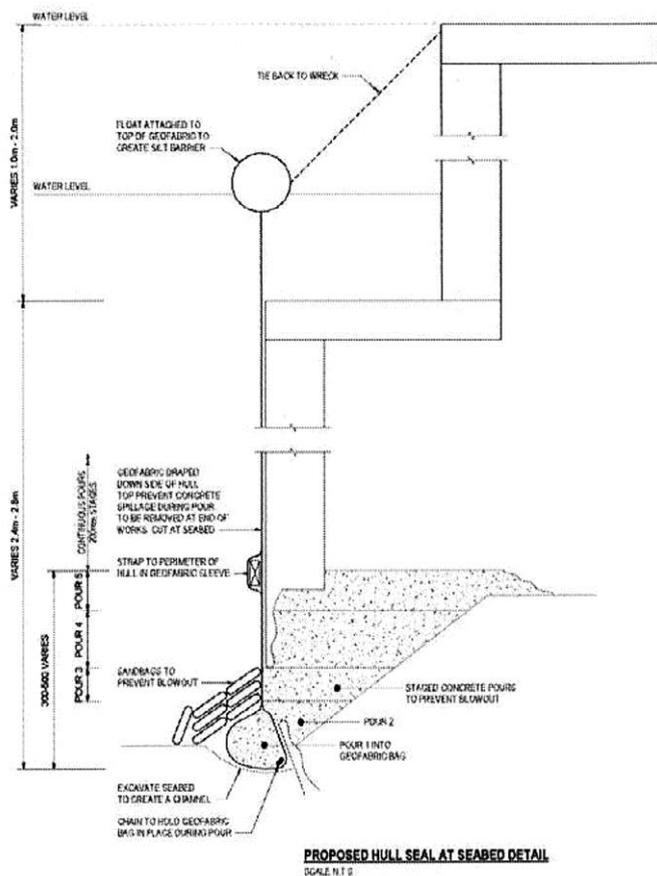


Figure 2 A part section of hull (not to scale) showing method of dealing with gaps at base of armour belt (source: Venturoni 2017)

6. Environmental considerations

The environmental survey conducted during DSTO investigation (Neill *et al.* 2012) concluded that The site contained no evidence of biological populations of any significance. The more recent survey by Professional Diving Services noted that the wreck exhibited a typical southern Australian shallow reef community dominated by the brown alga *Ecklonia radiata* as an overstorey with red turfing algae understorey. While short term impacts during infilling are likely to effect the community on the exterior hull, it is proposed that works would take place prior to *E. radiata*'s winter recruitment peak to maximise recolonization of any lost canopy cover. A regeneration time of nine to twelve months is to be expected. As marine biota present on debris from Cerberus adjacent to the wreck is not expected to be impacted, it, together with adjacent piling, is expected to act as a recruitment source as well as a refuge for mobile marine life (Silvey 2017).

The introduced Japanese seaweed *Undaria pinnatifida* was recorded as being present on Cerberus. This exotic pest species would be removed during infill works and throughout the post-impact monitoring program to avoid *Undaria* becoming dominant during recolonization by *Ecklonia* (Venturoni 2017:3, Silvey 2017). Studies have shown that removal of native algal canopy can promote invasion by *U. pinnatifida* (Edgar *et al.* 2004, Carnell and Keogh 2014). Any individuals of the invasive Northern Pacific Seastar *Asterias amurensis* will also be removed from the water during infill works and subsequent monitoring phases.

7. Monitoring and reporting

Monitoring of the site at three months, six and twelve months following installation of the infill. Inspections will determine the nature and magnitude of any structural settlement or movement that may occur and also observe and record recolonization by benthic communities. As noted above, post impact monitoring will include manual removal of the exotic pest alga *Undaria pinnatifida* for disposal in accordance with the National Control Plan for this species (Aqueal 2008).

Monitoring will consist of photographic quadrat surveys of hull communities before and after infilling, with baseline data derived from a pre-disturbance survey scheduled two weeks prior to commencement of works. During each survey, 15 photoquadrats 200 mm square will be taken on both port and starboard sides of the immersed hull. Photoquadrats will be analysed by using points cover abundance estimation software (transect measure) for species presence/absence and percentage composition. Biota will be identified to species where possible or to the nearest possible taxon. Collected data will be presented within a monitoring report.

A full account of the work done and any changes to the fabric of HMVS Cerberus during the infill process, together with details of materials used and materials left in place on the site, will be provided within a project report in accordance with the requirements of the Burra Charter Articles 31, 32 and 33, also Section 5 (Australian ICOMOS 1999:9, 17; Walker and Marquis-Kyle 2004:94-7).

8. Interpretation

Engaging, accurate and inspiring public interpretation both on shore and on site, together with enhanced accessibility for visitation, is an absolutely essential component of the conservation work required for *HMVS Cerberus*. However, it must be recognised that no budget is available to be allocated towards interpretation and access within the current project. When we have successfully stabilised the site, ensured the long-term existence of the vessel and mitigated the present public risks, the exclusion zone can be revoked. At that time, Bayside City Council will be in a position to seek substantial funding for this next important and exciting phase.

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22nd October 2017

9. References

- Anderson, R., 2002, *HMVS Cerberus Conservation Management Plan*, Heritage Victoria, Melbourne.
- Aquenal Pty. Ltd., 2008, National Control Plan for the Japanese seaweed or wakame *Undaria pinnatifida*, the National System for the Prevention and Management of Marine Pest Incursions, Australian Government Department of Agriculture, Fisheries and Forestry.
- Australia ICOMOS, 1999, *The Burra charter, the Australia ICOMOS charter for places of cultural significance*, Australia ICOMOS Inc., Burwood.
- Brown, D.K., 1992, 'The era of uncertainty 1863-1878' in Gardiner, R., *Steam, steel and shellfire, the steam warship 1815-1905*, Conway Maritime Press, London, pp. 75-94.
- Cahill, D., D. Carroll, R. Davenport, S. McKenzie and D. McPherson, 1983, *The Cerberus*, Maritime Archaeology Association of Victoria.
- Carnell, P.E., M.J. Keough, 2004, spatially variable synergistic effects of disturbance and additional nutrients on kelp recruitment and recovery, *Oecologia* 175, pp. 409-416.
- Colquhoun A.R. and Associates, 1994, *HMVS Cerberus – structural collapse 27th December 1993*, diving survey and report, unpublished report.
- Edgar, G.J., N.S. Barrett, A.J. Morton and C.R. Samson, 2004, Effects of algal canopy clearance on plant, fish and macroinvertebrate communities on eastern Tasmanian reefs, *Journal of Experimental Biology and Ecology* 312, pp. 67-87.
- Effenberger, S., 1995, *HMVS Cerberus archive directory*, unpublished report prepared for Heritage Victoria and Bayside City Council by HLA-Envirosciences Pty. Ltd. Newcastle.
- GHD (Gutteridge Haskins and Davey), 2000, *HMVS Cerberus: report on engineering feasibility study*, unpublished report to Heritage Victoria.
- GHD (Gutteridge Haskins and Davey), 2003, *HMVS Cerberus site investigations, final report*, unpublished report to heritage Victoria.
- Gillett, R., 1982, *Australia's colonial navies*, The Naval Historical Society of Australia, Garden Island.
- Gillett, R. and C. Graham, 1977, *Warships of Australia*, Rigby Limited, Adelaide.
- Herd, R.J., 1986, *HMVS Cerberus battleship to breakwater, historic iron monitor warship of the Victorian Navy*, The Sandringham Historical Series No. 3, City of Sandringham, Sandringham.
- Hewitt, G., 1999, *HMVS Cerberus – cathodic protection: a commentary*, unpublished report to Historic Shipwrecks Advisory Committee, Heritage Council Victoria.
- MacLeod, I.D., 1995, *An in situ study of the corroded hull of HMVS Cerberus (1926)*, unpublished report to maritime Heritage Unit, Heritage Victoria.
- MacLeod, I.D., 1999, *Conservation options for the wreck of the Cerberus/ review of consultant's reports re treatment options for HMVS Cerberus*, unpublished report for maritime Heritage Unit, Heritage Victoria.
- Neill, R., J.Gilbert, P.Graham, P.Mart, C.Grandison, M.Rowan and N. Winter, 2012, *Survey of HMVS Cerberus*, December 2012, unpublished report to Bayside City Council, Defence Science and Technology Organisation, Maritime Platforms Division, Fishermans Bend.
- Silvey, C., 2017, *Ecological assessment of protective works on HMVS Cerberus*, unpublished report to Bayside City Council, Professional Marine Science Services, Carrum Downs.

Solomons Corrosion Control Services Pty. Ltd., 1999, Cathodic Protection *HMVS Cerberus*: a preliminary investigation, document 2532, unpublished report to Heritage Victoria.

Strachan, S., 1995, Progress report, Cerberus Conservation Plan Project, unpublished report to Bayside City Council, Heritage Victoria, Melbourne.

Venturoni, M., 2017, Re: HMVS Cerberus infilling methodology and pricing summary for marine works, letter to Paul Gibbs, Bayside City Council, 11th October 2017.

Walker, M. and P. Marquis-Kyle, 2004, *The illustrated Burra charter, good practice for heritage places*, Australia ICOMOS, Burwood.