GML HERITAGE

# King George V Memorial

## Heritage Management Plan

### Volume 2: Conservation Works and Maintenance Program

**Report prepared for the National Capital Authority**

**May 2014**

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## Report Register

The following report register documents the development and issue of the report entitled King George V— Heritage Management Plan, undertaken by GML Heritage Pty Ltd in accordance with its quality management system.

| Job No. | Issue No. | Notes/Description | Issue Date |
|---|---|---|---|
| 12-0576 | 1 | Draft 1 HMP (Volumes 1 and 2) issued to the NCA | 15 April 2013 |
| 12-0576 | 2 | Draft 2 HMP (Volumes 1 and 2) issued to the NCA | 31 May 2013 |
| 12-0576 | 3 | Draft 3 HMP (Volumes 1 and 2) issued to the NCA | 26 September 2013 |
| 12-0576 | 4 | Final HMP (Volumes 1 and 2) issued to the NCA | May 2014 |

## Quality Assurance

GML Heritage Pty Ltd operates under a quality management system which has been certified as complying with the Australian/New Zealand Standard for quality management systems AS/NZS ISO 9001:2008.

The report has been reviewed and approved for issue in accordance with the GML quality assurance policy and procedures.

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# 1.0 Introduction

Godden Mackay Logan Heritage Consultants (GML) was commissioned by the National Capital Authority (NCA) in January 2013 to prepare a Heritage Management Plan (HMP) for the King George V Memorial (Memorial).

The HMP updates the Conservation Study developed by Freeman Collett & Partners in 1994 (1994 Conservation Study). The HMP updates the 1994 document to ensure compliance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It is consistent with the regulations of the EPBC Act; Schedule 7A management plans for Commonwealth Heritage places.

Volume 1 of the HMP is the management planning document, while this Volume provides a 'Conservation Works and Maintenance Program' for the memorial.

It provides clear direction for the conservation, protection, repair and maintenance of the King George V Memorial (the memorial). The works program complements the heritage values identified in Volume 1: Section 4.0 and provides the implementation strategy for policies included in Volume 1: Section 6.0 —Policies 8.1 and 8.2.

The condition of the memorial's fabric is discussed in detail (Volume 2: Section 6.0). Required remedial and preventive works to the memorial are identified and prioritised. Recommendations for immediate and short term works are sufficiently detailed so that the information can be used as a basis for project briefs and specifications. General costings are also provided to assist the NCA in budget planning.

A cyclical maintenance schedule is included in Volume 2: Section 8.0 and presented in a tabular format to facilitate ease of use.

Volume 2 has been prepared by Gillian Mitchell, Conservator of Conservation Works, David Young, Heritage Consultant and GML's project team (refer to the authorship section in Volume 1: Section 1.0).

# 2.0 Method

Visual inspections were completed in 2011, 2012 and February 2013. All accessible spaces of the memorial—inside and out—were visually assessed. A cherry picker was used to access the roof and exterior high sections.

All available files and plans held by the NCA were reviewed to inform understanding of the construction and previous conservation of the memorial.

Findings and recommendations from a concurrent technical specification project (being completed in conjunction with David Young, Heritage Consultant) have been incorporated.

The findings and recommendations from Mott MacDonald, Structural Engineers, for this HMP have also informed the development of this document.

The outcomes of the site visits and data review are included in the Prioritised Work Program (Section 7.0) and Cyclical Maintenance Schedule (Section 8.0).

# 3.0 Description

The image below indicates the terms which are used to refer to the various parts of the memorial.

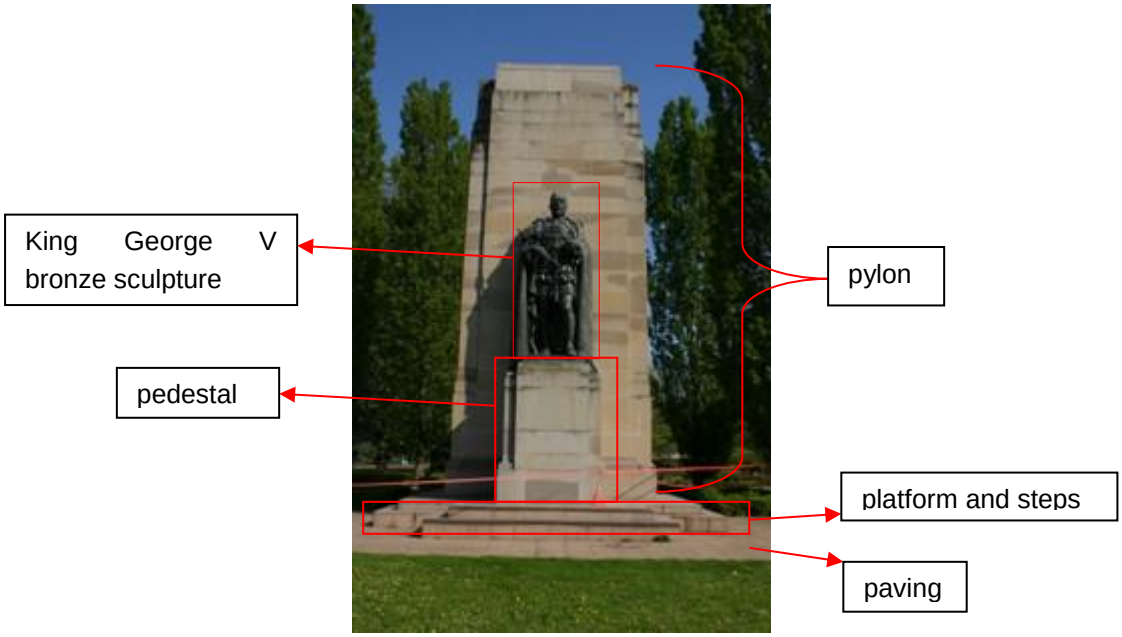


**Figure 1:** Elements of the memorial referred to in the HMP. Other elements not visible in this picture include the sandstone statue of Saint George, lettering and circular bronze plaques.

The following table details the materials of which the memorial is constructed. It is important to note that the memorial was relocated to its current position in 1968. Major repair works were undertaken in 1996. Consequently, the memorial has material dating from the 1940s, 1960s and 1990s.

| Element | Summary Condition |
|---|---|
| King George V Memorial—the whole memorial (materials). | Fair |
| King George V Memorial—the whole memorial (structure). | Good |
| Form—the stepped and tapered architectural arrangement has a central (hollow) pylon that is a composite of sandstone (outside) and brick (inside) on a concrete footing. It includes sculptural elements described below. | Fair |

**Original Fabric (1940s and 1950s)**

| | |
|---|---|
| Sandstone from the Sydney region. | Poor |
| Mortar—only pointing in mason's putty of 'fake' joints remains. | Fair |
| Carved figure of Saint George on horseback—sandstone as above. | Fair |
| Lettering in sandstone—on the pylon and pedestal. | Fair (due to condition of stone) |

| Element | Summary Condition |
|---|---|
| Bronze elements:<br>• Sculpture of King George.<br>• 10 individual circular plaques.<br>• Saint George's lance. | Good |
| **Introduced Fabric (from 1968 relocation and later)** | |
| Interior brickwork—common red brick in a cement: sand mortar. | Good (despite brick growth) |
| Granite steps and paving of platform which replaced the original platform in the 1968 relocation (some original granite was re-used). | Poor (due to skateboarding wax) |
| Paving— granite introduced in 1968. | Good |
| Mortar—1996 repointing in lime: sand mortar. | Poor (much has failed) |
| New access tunnel and internal infrastructure, 1996—including platforms and ladders in pylon, ventilation ducting and fan, electrical system. | Fair. The access hatch was broken at the time of the site visit. Leaf litter and mud covers floor. Internal lighting did not work. |
| Internal sacrificial plaster, 1996—lime: sand plaster. | Poor (badly decayed by damp) |
| Anti-skateboard guards—inserted in joints in platform in 1996. | Poor (all removed) |
| Roof—copper cladding over concrete, 1996 copper-clad hinged hatch. | Good |

# 4.0 Previous Conservation Work

## 4.1 1994 Conservation Study Recommendations

The 1994 Conservation Study (Freeman Collett & Partners, Young and Pearson) identified a range of remedial works required to stabilise the fabric of the memorial as an interim measure, pending a decision as to its possible relocation. The works required at that time are summarised below:

- improving interior access;
- cleaning, consolidation and reinstatement of coping stones;
- investigation of moisture flow through paving area and concrete slabs;
- reduction of internal condensation;
- replacement of internal drainpipe;
- reinstitution of the hatch;
- methods for reducing copper and iron corrosion products;
- sacrificial rendering interior walls below the damp proof course;
- eliminating tree root penetration and preventing reoccurrence;
- cleaning and coating of copper elements;
- stone consolidation, repointing and plastic repairs; and
- removal of lichen from stonework.

Most of these issues were addressed in a 1996 program of works, which included introduction of a subterranean access tunnel as well as a series of galvanised steel platforms and ladders to provide internal access to the top of the pylon.

## 4.2 Summary of Work Undertaken Since 1996

This section provides a summary of the work completed in and since 1996—as extracted from the NCA files.

- Repointing of all 'real' joints in sandstone with a 1:3 lime: sand mortar mix. Failure of the pointing was noted in the NCA files one year after completion in 1997. David West of ARUP Façade Engineering was contracted to identify the defects, investigate the causes and propose methods of rectification.
- Replacement of coping stones (rather than the recommended consolidation trials) and installation of new copper flashing at the top of the pylon.
- Fills to damaged areas of sandstone with epoxy-bound sand patches on stainless steel wire armatures. These appear to have been problematic from installation. They are described in 1997 correspondence as having a distinctly green cast and a limited life expectancy (approximately 10 years).

- Dressing back and reshaping of badly damaged stone to sound material. In some instances dressing of stones was used to create water shedding surfaces.
- Wax application to the surface of all bronze elements.
- Construction of new internal access, hatches and drainage.
- Installation of lighting and a ventilation fan.
- Removal and replanting of the nearby poplar trees, in part to address damage to the granite-clad platform and paving of the memorial caused by root growth.
- Introduction of a root barrier at the time of replanting (shown in Freeman Collett & Partners architectural drawing of May 1994).
- Application of a sacrificial plaster to the interior brickwork to a height of about 2m.
- Application of an anti-graffiti coating (extent and material unknown).
- Possible stone consolidation to cracks in unknown locations.
- Some replacement of granite stones in the paving and platform (locations unknown).

# 5.0 Current Location

## 5.1 Introduction

The re-siting of the memorial to its current location has been discussed in Volume 1 of this HMP. The 1968 relocation has compromised the appreciation of the memorial itself as well the qualities of the landscape planting of the central axis. Consequently, the question of a further relocation of the memorial has arisen on several occasions, including in the 1980s and again in the 1990s.

The 1994 Conservation Study canvassed a range of options for the memorial including conservation in situ (with and without the adjacent poplars), relocation to its original site and in its original form, and relocation to an alternative site in close proximity to Old Parliament House. The study's preferred conservation policy was that the memorial eventually be relocated to a more appropriate site. However, because relocation remained an unresolved issue, the study recommended an option of conservation in situ with a reduced scope of works, on the basis that a more thorough program of works be undertaken once a final location had been determined.

From a materials conservation perspective, there are advantages and disadvantages to deconstructing and then reconstructing the memorial as below. Please note the potential impact on heritage values is discussed in Volume 1.

## 5.2 Advantages of Reconstruction Associated with Relocation

- Reconstruction would enable the construction of a footing to contemporary standards (though performing satisfactorily to date, the present footing is considered substandard). The new footing structure could be designed to overcome the subsoil moisture issues.
- Reconstruction would enable use of certified no-growth bricks and permit proper bonding of stones and brickwork with the incorporation of cramps and ties as appropriate.
- Bowed stones could be cut and more readily built into the structure in their proper positions.
- Decayed stones could be more readily replaced with new stones.
- Recovery of the form of the memorial (by replacing damaged stones, not necessarily by reconstructing the original podium).
- Joint widths could be returned to their intended 3mm.
- Interior of the bronze sculpture could be accessed and treated to prevent internal corrosion.

## 5.3 Disadvantages of Reconstruction Associated with Relocation

- High cost—may be several times that of conservation in situ.
- Potential damage to fabric during dismantling and reconstruction.

## 5.4 Conservation challenges

Despite the advantages of reconstructing the memorial, a monument such as the King George V memorial will always have conservation challenges. On balance, the conservation outcomes of moving the memorial are not sufficiently advantageous to recommend this as the preferred option. Volume 1 of this HMP identifies that memorial has heritage values in its current location and

therefore, conservation of the memorial in situ the preferred course of action. All recommendations in the remainder of this report are made on the basis of the memorial staying in its current position.

The conservation challenges include:

- Bowed and displaced stonework presents a complicated conservation challenge requiring skills not normally found in the building industry.
- Until growth of the present brick core ceases, there will always be a likelihood of ongoing water penetration into the masonry due to the opening of mortar joints.
- Maintenance and conservation interventions will be more frequent and more expensive.

Irrespective of possible future decisions about relocation, the conservation of the memorial in its present location should be undertaken on the basis that it will remain in this location. Work programs that are based on a reduced scope (ie stopgap measures) in anticipation of future relocation will inevitably lead to poor outcomes. The condition of the memorial is such that it cannot afford more decades of water penetration into the masonry.

# 6.0 Condition Assessment

## 6.1 Introduction

The condition of the sculpture was assessed visually from the ground and with the aid of a cherry picker.

The stonework of the King George V Memorial is in poor condition. The underlying cause is slow growth of the brickwork of the composite stone and brick structure which is forcing open the joints between blocks of sandstone, thus allowing water penetration into the masonry. Sandstone blocks are in turn bowing because they are not restrained. The sandstone is also cracking and delaminating due to excessive moisture movement through the joints and the stones.

The diagnosis of brick growth was first made 20 years ago and is reported on in Young, 1992, and Freeman Collett & Partners, Young and Pearson, 1994. Brick growth is a widely observed phenomenon; it is a gradual response of the brick to its new environment on leaving the kiln. Absorption of water promotes recrystallization of some clay minerals in the brick, resulting in a progressive increase in size which may continue for 50 or more years. Not all varieties of brick suffer this problem, but it is well known in Canberra. Expansions up to 0.1% of original length are common. It is apparent from the survey conducted in November 2012 that the growth of the (1968) brickwork may not have ceased, as many of the joints that were repointed in 1996 have failed and now show cracks alongside the replacement mortar, indicating opening of the joints since repointing.

Biological staining, which adds to the disfigurement of the memorial, is made worse by the water penetration. The choice of elastomeric sealant for the mortar joints for the 1968 relocation has added to the decay of the sandstone by trapping moisture and forcing it to evaporate through the stones (until the sealant failed). Most of the sealant was removed in the 1996 works, but the replacement mortar has failed badly, allowing more water penetration into the structure.

The granite-clad concrete platform is generally in good condition except that the eastern surfaces are badly disfigured as a result of skateboarding; thick accumulations of wax and mechanical damage to the edges of some stones are apparent. The central joint in the platform has opened, indicating minor differential settlement between the main brick structure and the surrounding concrete platform.

The bronze figure of King George V is in generally good condition, requiring only cleaning and routine re-waxing.

The subterranean passage into the core of the memorial has accumulated dirt and leaf litter so that it is now deep in mud, leading to decay of internal plaster due to dampness and salt attack.

## 6.2 Condition Assessment of the Elements

### 6.2.1 Sandstone

The poor condition of the sandstone (found in the pedestal, pylon and sculptural elements) is summarised in the following points and discussed in more detail in the subsequent paragraphs:

- lack of restraint and excessive water penetration has led to bowing of many stones;

- there may be few, or no, restraining cramps tying stones together;
- brick growth has jacked open the facade stone (this may also have been an issue for the memorial in its original location);
- delamination of outer surfaces of many stones and associated marginal cracking is due to the inherent nature of the stone, made worse by excessive water penetration; many stones have been dressed back to sound material;
- other cracking in smaller sections of stone and along some bedding planes;
- granular disintegration of smaller sections and other highly stressed areas;
- repair of exposed top corners and edges with epoxy-bound sand patches;
- indenting of some stones and replacement of others; and
- tearing apart of some stones due to shrinkage of elastomeric sealants.

The expansive growth of the brickwork has turned what was intended as a composite structure of brick and stone into a central brick core with a loose 'cladding' of sandstone blocks. Many, if not most, mortar joints are open or cracked, allowing water penetration vertically and horizontally into the structure. The brick growth has relieved much of the overlying load on the sandstone and so the unrestrained blocks have bowed due to excessive moisture, causing swelling of their rear surfaces (relative to the faces which remain drier and are case-hardened, reducing their movement). Bowing was apparent in the early 1990s and may have worsened since. As well as bowing about a vertical axis, some stones show slight cupping about a horizontal axis, though this may be due to a slight concaving of the surface, during original finishing, or perhaps as a result of rubbing down the stones during the 1968 reconstruction in the present location.

**Figure 2:** Example of open joints and movement of sandstone blocks on the northern face.

It is unclear whether there are any restraining cramps tying stones together and back to the brick core. The 1937 specification called for the use of galvanised iron cramps but there are no records of their frequency and location, nor is it clear if they were replicated during the 1968 reconstruction. While there may be some cramps tying stones together and back to the brickwork (most likely near the top of the pylon), there are unlikely to be any pins as the stone and brickwork was built as a single entity with a composite structure typical of the time of its design. Bowing and displacement of many stones indicates that they are not restrained by cramps. The lack of staining from corroding metals suggests that cramps were not used, but were incorporated instead and have subsequently failed.

It is appropriate to realise that the 1941 structure in its original location may have suffered from the same brick growth problems even though the present bricks date from the 1968 relocation. There are file records from 1962 indicating the need for substantial repairs to the stonework and while this is not proof that brick growth was occurring in its first location, it is certainly a possibility. If so, it indicates that the decay of the stone has happened over about 70 years rather than over the 45 since relocation.

Many of the sandstone blocks show evidence of delamination of surfaces and related cracking which is parallel and close to the outer margins of the stones. Some stones were so severely decayed they were dressed back to remove the delaminating material during the 1996 works, the complete course just below the inscription on the west face being an example of this. Other stones have been redressed only in those areas that were delaminating, leaving uneven surfaces that are particularly apparent in raking light.

**Figure 3:** Example of cracking, delamination and granular disintegration on the southern face.

Other cracking can be seen at right angles to stone edges (along what appears to be bedding planes), and also in areas of smaller cross section such as the hands, gloves, arms, knees and feet of the Saint George figure.

Granular disintegration of the sandstone is apparent in some of the above mentioned areas of Saint George's limbs. It is also seen at the bottom corners of blocks adjacent to mortar joints that were once filled with elastomeric sealant, forcing moisture to evaporate through the stones and so concentrating decay at these points.

Similar disintegration probably occurred at the exposed top corners and edges of many stones, leading to their repair in epoxy-bound sand patches as part of the 1996 works. These patches are

understood to have discoloured fairly quickly to a distinct green colour which is now muted to a more neutral colour, although still not a good match for the sandstone. The epoxy-based repairs are deteriorating, showing a distinct loss of material and surface retreat below that of the adjacent sandstone, with the stainless steel armatures exposed in places. Though decaying, the epoxy-patching is appropriately weaker than the stone and is therefore probably not contributing to further decay of the stone.

**Figure 4:** Example of epoxy resin repair on the southern face.

Some stones have been indented with new sections of sandstone, particularly along the top of the pedestal supporting Saint George on horseback. This work was probably undertaken during the 1968 relocation. The stones forming the coping to the top of the pylon were replaced during the 1996 works and the originals are now stored within the core of the memorial.

Shrinkage of elastomeric sealants (which should never be used with sandstone) has resulted in some stones being torn apart parallel to joint surfaces, further opening cracks which may have already been there due to the marginal cracking and delamination that is characteristic of this sandstone.

### 6.2.2 Mortar Joints in the Sandstone

It is important to realise that there are many 'fake' joints in the stonework; they are shallow grooves filled with mason's putty, all of them vertical, and apparently dividing what are in fact much larger (longer) sandstone blocks. Despite being repointed in 1996, much of the pointing mortar in the 'real' joints of the sandstone work has failed. The condition of the joints is summarised in the following points and discussed in more detail in the subsequent paragraphs.

- most of the 'real' joints have failed, showing extensive cracking and loss of pointing mortar;
- 'real' joints are now much wider than the 'fake' joints, detracting from the aesthetics of the memorial;
- loss of mason's putty from fake joints;
- elastomeric sealant continues to cause damage to the Saint George figure; and
- some vertical joint surfaces have been painted, rather than pointed.

Failure of many of the ‘real’ joints is expressed as deep cracking between stone and pointing mortar which is often loose and easily removed. In places the 1996 pointing is missing entirely; and where present, it is weak and crumbly. Failure of the pointing is due to two factors; ongoing brick growth widening the joints and allowing water penetration as already noted, and decay of the pointing mortar itself, which may be due to poor curing of the new mortar. It is understood that there were problems with the pointing within 12 months of completing the 1996 work.

Because of the growth of the brick core, the ‘real’ joints are progressively getting wider and now, at up to 10mm wide, look very out of place compared to the intended 3mm joint width as evidenced by the ‘fake’ joints and the 1937 specification (Foskett, 1937). This problem, which contributes to the disfiguring of the memorial, may have been compounded during the 1968 relocation by building in joints that were wider than originally intended.

**Figure 5:** Example of mortar pointing failure.

Mason’s putty is missing from some of the ‘fake’ joints, adding to the poor aesthetics.

Though removed from most of the memorial, elastomeric sealant remains in a wide vertical joint behind the neck of the horse of the Saint George figure. Shrinkage of the sealant has torn open some of the joint allowing water entry, while preventing moisture evaporation elsewhere.

In what may be a case of misspelling (coupled with ignorance), some joint surfaces have been painted rather than pointed. White paint has been applied to joint faces of stones in some vertical joints. When this was done is not clear, but some joints show failing 1996 mortar with painted surfaces beneath. The paint will prevent adhesion of mortar, compounding the joint problems. In a similar way, any residue from the previous pointing with elastomeric sealant may be making the joint surfaces water-repellent, or partially so, further reducing the chances of good bonding between mortar and stone.

### 6.2.3 Granite Steps and Paving

*Steps and Paving*

The sandstone memorial is surrounded by granite paving and steps. Though some of the granite paving may have been reused, the stepped platform that surrounds the memorial dates from the 1968 relocation and is a considerable reduction from what was a substantial podium in the original version.

These elements generally appear to be structurally sound. There is a slight camber on the platform surface, higher at the centre (which is presumably to allow water to run off the surface), though it may be partly due to settlement of the outer edges of the concrete platform on which the granite steps are laid.

**Figure 6:** Central platform joint.

The granite is in good condition except that the eastern steps are badly disfigured as a result of skateboarding activity. Thick accumulations of wax and mechanical damage to the edges of some stones are apparent.

There are isolated locations near the edge of the garden beds where the paving has been lifted by tree roots creating a potential trip hazard.

*Anti-skateboard Guards*

Stainless steel anti-skateboard guards had been installed in the vertical joints between granite paving slabs, but these have all been removed. Installation of guards in the joints may seem like the appropriate minimal intervention solution, but it doesn't work; thermal expansion of the steel and the granite will weaken the bond in the joint, making removal more straightforward, as well as stressing the stones and potentially widening the joints. Guards should be inserted into holes drilled in the granite, midway along each slab.

**Figure 7:** Example of skateboard damage to granite steps—note wax and missing skateboard deterrents.

### 6.2.4 Bronze Sculpture of King George, Bronze Plaques and Bronze Lance

The figurative sculpture, plaques and lance are cast from bronze. They have a maintainable wax finish on the surface, last applied about six years ago. Other than some minor surface dirt and corrosion these elements are in good condition. Note that it is not possible to assess the interior of the main sculpture.

**Figure 8:** Bronze sculpture, note white marks on the cape are the old wax coating breaking down.

### 6.2.5 Roof

The top of the memorial has a low parapet wall of sandstone (replaced in 1996). The roof surface is copper sheeting on a screed over concrete. The roof is accessed through the interior, via the manhole in the pavement and out a hinged hatch at the top of the pylon. The 1996 ventilated roof hatch is jammed and cannot be readily opened.

The manhole on the ground has a broken lock and is unsecured. There are beer bottles up the top indicating that someone makes use of this space.

**Figure 9:** External view of roof.

### 6.2.6 Interior Including Electrical and Stormwater

Despite the long-term slow expansive growth of the bricks, the brick core of the memorial is in good condition with no significant cracking or other signs of damage, the exception being some salt attack damage. This is due to excessive moisture penetration through the core and rising damp at the base. The latter is made many times worse by the accumulation of debris trapping water within the interior. Among the accumulations of white salts, some may be less harmful carbonates, these indicate dissolution of mortars and concrete slabs.

**Figure 10:** Interior, note sacrificial plaster, salt and water damage.

A sacrificial plaster was applied to the lower parts of the interior wall surfaces in 1996 as a protective measure (salts evaporate at the plaster surface rather than the brick surface, and all associated damage occurs at the plaster face rather than the brick). It has performed its protective function well as the dampness and associated salt attack has caused the loss of much of the 1996 plaster (it is totally missing in some areas). Salt attack damage extends beyond the plaster and into the brickwork above.

The floor of the interior is completely covered to some depth in mud and leaf litter. High 'tide' lines indicate that stormwater has been up to a metre deep in the recent past. Other debris includes items such as shoes that have been brought in by visitors who have been able to access the interior because the ground level manhole has not been locked. Stored within the interior space are large pieces of sandstone removed from the coping of the pylon during the 1996 works.

## 6.3 Biological Growth

Lichen and algae have colonised the stonework in many places, particularly the south side horizontal surfaces and at the top of the pylon. This biological growth contributes to the (slow) breakdown of the surface of the stone, making it more prone to moisture ingress and decay.

**Figure 11:** Dark algae staining and lichen on highest stonework.

## 6.4 Graffiti

There are numerous small pieces of graffiti on the stone walls; there is also some scratching damage that may have been deliberate. The graffiti contributes to the worn and battered appearance of the memorial.

**Figure 12:** An example of applied and incised graffiti.

## 6.5 Adjacent Trees

The two adjacent poplar trees planted in 1996 are now substantial. While deterioration to the platform and pedestal of the memorial are not currently apparent, roots are causing uplift in the surrounding granite paving. The memorial is described as sitting on 'under designed' footings (G Plohberger—Structural Engineer, Preliminary Structural Report, 1996) making it vulnerable to movement induced by tree root growth. The conservation of the memorial is best served by the removal of the adjacent trees. It could be anticipated; however, that some settlement would occur after the removal of the trees as remnant roots rot away.

The 1994 proposed installation of a root barrier seems likely to have occurred because there are no obvious tree roots penetrating the underground area of the memorial. However, there is no physical evidence (visual inspection 2013) of the root barrier being installed.

# 7.0 Prioritised Work Program

## 7.1 Introduction

The required works have been grouped into the categories listed below according to the urgency of the work.

Immediate: within 6 months—tasks that fall within this category are safety and security related.

Short term: 6-12 months—these tasks include a comprehensive range of treatment trials. Trials of treatment techniques are essential to ensure good quality, long-term outcomes in the medium and long-term works. The complicated nature of the fabric of this memorial necessitates trials before committing to full work programs. The failure of the 1996 mortar in 1997 is an example of issues that can be avoided by the use of comprehensive trials.

Medium term: 1-2 years—these tasks are actual completion of the higher priority remedial work.

Long term: 2-5 years—these tasks are actual completion of the lower priority remedial work.

Ongoing—this applies to cyclical maintenance.

All of the recommendations made by David Young (Heritage Consultant) and Mott MacDonald (Structural Engineers) have been incorporated into these tables.

In some cases, estimated costs have been provided to assist with budget planning. Costs have not been included for medium or long-term tasks as appropriate techniques will not be known until after the completion of the trial (short-term) phase.

## 7.2 Immediate Tasks

These tasks should ideally be completed within six months.

| TASK | METHOD | ESTIMATED COST |
|---|---|---|
| 7.2.1 Resolve OH&S issues regarding interior space. | Resolve whether the interior should be considered a confined space for OH&S reasons.<br>Prepare a Safe Work Method Statement for any staff and contractors entering the space. | $2000 + GST for a workplace safety consultant. |
| 7.2.2 Clean out subterranean access and interior space. | Remove leaf litter mud and other debris from the interior using shovels and buckets for off-site disposal. Cover over drain entry to prevent blockage during work.<br>Lightly spray plastered wall surfaces to remove loose material; collect from the floor and remove.<br>Clean out drain and ensure that it is functioning. Repair if needed. | Not applicable—can be completed by NCA maintenance staff. |
| 7.2.3 Repair lock to ground level hatch. | Make necessary repairs to ensure that ground level hatch is lockable and tamper-proof. | $500 + GST for a locksmith. |

| TASK | METHOD | ESTIMATED COST |
|---|---|---|
| 7.2.4 Check electrical systems and repair if needed. | Ensure that all electrical systems are functioning correctly. The ventilation fan is to remain switched off. | $200 + GST for check only by electrician, repairs additional. |
| 7.2.5 Repair roof hatch. | Repair jammed roof hatch so that it functions correctly. Ensure that interior is naturally ventilated through the grilles in the roof hatch. | $1000 + GST by locksmith or building contractor. |
| 7.2.6 Resolve paver trip hazards. | Lift and relay any pavers that represent a trip hazard to the visiting public. | $2000 + GST by a paving contractor. |

An estimate of costs for all the immediate tasks (7.2.1–7.2.6, but not including those to be done by NCA maintenance staff, 7.2.2) is $6000 plus GST.

## 7.3 Short-Term Tasks

These tasks should ideally be completed within one year.

| TASK | METHOD |
|---|---|
| 7.3.1 Trial removal of biological soiling. | Use a quaternary ammonium compound such as 'Wet and Forget' at 2% dilution applied by brush. |
| 7.3.2 Trial removal of graffiti. | Use a range of paint stripper solvents to trial graffiti removal. |
| 7.3.3 Trial removal of skateboard wax. | Use a range of solvent and heat techniques to develop a wax removal system. |
| 7.3.4 Analysis of salt accumulations from interior surfaces. | Collect four samples of different accumulations and submit for ion-chromatography of common soluble salt ions. |
| 7.3.5 Analysis of mortar samples. | Collect up to four samples of mason's putty from 'fake' joints and any early mastic sealant and submit for analysis for lead and asbestos. Wear appropriate safety equipment when collecting samples. |
| 7.3.6 Trial colouring and consolidation of epoxy-bound patches. | Trial a range of products such as diluted mineral silicate paints as colourants and mild consolidants. |
| 7.3.7 Trial application of 'anti-hygro' on decaying sandstone. | Trial use of 'anti-hygro' product on sandstone to limit swell/shrink of clay minerals due to changes in moisture content. |
| 7.3.8 Trial consolidation of decaying sandstone. | Trial use of ethyl silicate based consolidants on areas of decaying sandstone. Use a range of viscosities. |
| 7.3.9 Trial injection of resins into cracks in sandstone. | Trial injection of low-viscosity adhesive resins (epoxy or polyester) into cracks in sandstone. |
| 7.3.10 Investigate presence of any cramps restraining stone blocks. | Visual examination in conjunction with 7.3.12 below. Consider also impulse radar survey. |
| 7.3.11 Investigate extent of voids behind bowing sandstone blocks. | Visual examination in conjunction with 7.3.12 below. Also use hoses and monitor for water penetration. |

| TASK | METHOD |
|---|---|
| 7.3.12 Removal and reinstatement of bowed sandstone blocks. | Trial removal of at least two bowed sandstone blocks. Saw stone along 'fake' joint lines and reinstate separate pieces in their previous locations. Test fit and reseating of blocks. Undertake 7.3.10 and 7.3.11 while blocks are removed from pylon. |
| 7.3.13 Trial repointing of joints in sandstone and granite paving. | Trial cutting out and repointing of a range of joint styles, 'real' and 'fake'. Real joints will require deep repointing to take up expansion of brickwork. |
| 7.3.14 Trial of injection grouting of voids behind sandstone blocks. | Trial grouting of voids to reinstate the integrity of the composite stone and brick construction. Grouting may need to be undertaken from the outside and from the inside, through holes drilled through the brickwork. |
| 7.3.15 Trial application of anti-graffiti coating to sandstone and granite. | Investigate and trial application of anti-graffiti products. |
| 7.3.16 Establish crack monitoring sites. | Select up to five locations to document as monitoring sites for significant movement. The sites should include the central platform joint and some bowed sandstone panels. |
| 7.3.17 Report on results of investigations. | Report on results of investigations and chemical analyses, review and revise work program accordingly, prepare specifications for works, and prepare costing of specified works. |

All tasks recommended in section 7.3 (short-term works) should be carried out by a materials conservator with assistance as needed from materials experts, stone masons and building contractors.

An estimate of costs for all the short-term tasks (7.3.1–7.3.17) is $47,000 plus GST.

## 7.4 Medium-Term Tasks

These tasks are indicative only—the actual tasks required will depend on the outcomes of the trials recommended in 7.3 Short-Term Tasks and reported on in 7.3.17. Medium-term tasks should ideally be completed within two years.

| TASK | ACTIVITY |
|---|---|
| 7.4.1 Cleaning of the sandstone. | • removal of biological staining.<br>• graffiti removal. |
| 7.4.2 Repairs to sandstone. | • removal of bowing stones, sawing along 'fake' joints and reinstatement.<br>• deep repointing of all the 'real' joints in the sandstone.<br>• injection of grouts into voids behind sandstone blocks.<br>• surface repointing of all joints, including to 'fake' joints where needed.<br>• removal of mastic sealant from sculpture.<br>• filling of resulting wide joint to look like sandstone.<br>• repairs to 1996 copper flashing near top of pylon. |

| TASK | ACTIVITY |
|---|---|
| 7.4.3 Consolidation and protection of weak sandstone. | • anti-hygro treatment to control swell/shrink of sandstone.<br>• consolidation using ethyl silicate-based consolidants.<br>• injection of adhesive resins into cracks.<br>• application of weathering fillets to limit water entry into delaminating stones.<br>• colouring and consolidation of epoxy-bound patching.<br>• anti-graffiti treatment. |
| 7.4.4 Interior repairs. | • removal and replacement of sacrificial plaster.<br>• desalination treatment if required.<br>• extension of plaster if needed. |
| 7.4.5 Cleaning and repair of the granite platform. | • removal of skateboard wax.<br>• repointing of joints in paving: mortar and mastic.<br>• insertion of new anti-skateboard guards. |
| 7.4.6 Conservation of bronzes. | • cleaning and repatination if required.<br>• waxing of surfaces. |

## 7.5 Long-Term Tasks

These tasks should ideally be completed within five years. Like the medium-term tasks, they are indicative only—the actual tasks will depend on the results of the investigations and trials recommended in 7.3, Short-Term Tasks, as well as the further works that remain to be confirmed as part of the monitoring and review recommended in 7.5.1, below.

| TASK | ACTIVITY |
|---|---|
| 7.5.1 Monitoring and review of conservation outcomes. | • periodic monitoring of condition of memorial.<br>• review of conservation outcomes. |
| 7.5.2 Consideration of further works. | • replacement of dressed-back stones on the pylon.<br>• replacement of other decayed stones.<br>• replacement of epoxy-bound patches with indents, or more patches.<br>• retreatment of decaying sandstone with anti-hygro and/or consolidants.<br>• replacement of internal sacrificial plaster.<br>• additional internal sacrificial plastering or limewashing. |
| 7.5.3 Review of maintenance program. | • revision if required. |

## 7.6 Ongoing Tasks

Implement the Cyclical Maintenance Schedule included in Section 8.0.

# 8.0 Cyclical Maintenance Schedule

## 8.1 Introduction

Tasks have been grouped according to the frequency with which they should be performed. There are tasks to be performed on a quarterly, six monthly, annual, five yearly and ten yearly basis. There are also some tasks that need to be completed on an as needed basis, for example, graffiti removal. Appropriate methodologies for these tasks are also included.

## 8.2 Tasks

| TASK | METHOD | REGULARITY |
|---|---|---|
| **General site inspection** | NCA maintenance staff should check condition and arrange repair of:<br>• Tree root invasion—lifting pavers creating trip hazards.<br>• Large-scale damage from tree branches, cars etc.<br>• Graffiti.<br>• Missing skateboard deterrents.<br>• Damage to locks and hatches.<br>• Functioning of internal electrical system. | **Quarterly** |
| **Cleaning of round bronze plaques** | The round bronze plaques should be washed with tap water applied on a microfiber cloth. This work should be completed by NCA maintenance staff. | **Quarterly** |
| **Cleaning of subterranean access way** | NCA staff should clean the subterranean access tunnel to avoid debris build up and associated flooding.<br>• Dirt and leaves should be shovelled from the tunnel and removed from site (the drain entrance should be covered during this work to avoid blocking it). | **Quarterly** |
| **General surface clean** | Clean all parts of the memorial with a soft nylon broom and a leaf blower:<br>• This work should be completed by NCA maintenance staff.<br>• Cleaning should be completed from a cherry picker.<br>• Cleaning should commence from the top and move downwards.<br>• Surface dust, rubbish and cobwebs should be gently brushed or blown from the surface. Special care should be taken not to scratch or scrape the surface. Nooks and crannies on the sculptural elements will require the most attention. | **6 monthly** |
| **Cleaning of stormwater drains** | The stormwater drains should be cleaned with a truck mounted suction unit to ensure they are free flowing. | **6 monthly** |

| TASK | METHOD | REGULARITY |
|---|---|---|
| **Cleaning of gutter and internal downpipe** | NCA maintenance staff should clear the roof gutter of leaves and rubbish. The functioning of the downpipe should also be tested by pouring a bucket of water down the pipe to ensure it is clear. It will be easiest to clean the roof gutter from the cherry picker. | **6 monthly** |
| **Cold waxing of round bronze plaques** | The round bronze plaques should be waxed to protect the surface of the bronze and prevent green run-off staining of the stone. Cold waxing of the plaques should be done more frequently than the hot waxing described below.<br>This work should be completed by a conservator or NCA maintenance staff after training.<br>The plaques should be polished with a cold application of microcrystalline wax paste applied with a soft cotton rag. Renaissance wax is a suitable product. Care should be taken not to get wax onto the surrounding stone. | **Annually** |
| **Monitoring of key cracks** | Movement and change monitoring sites should be checked and accurate measurements taken. Any significant change will be an early warning of potential structural issues. | **Annually** |
| **Biocide application to control biological growth** | A spray application of a 2% solution of a quaternary ammonium compound biocide (such as 'Wet and Forget') should be made to the affected sandstone surfaces. | **Every five years** |
| **Hot waxing of bronze sculpture, round plaques and lance** | A sculpture conservator should use a hot application method to apply a protective microcrystalline wax coating. 'BeSq195' is a suitable wax.<br>The surface should be washed and old wax removed as part of hot waxing. | **Every five years** |
| **Reinspection by a structural engineer** | A structural engineer should be engaged to inspect the structure inside and outside, and to advise on any potential safety issues. | **Every ten years** |
| **Removal of graffiti** | A materials conservator should advise on all graffiti removal. The sandstone surface is very vulnerable to abrasive methods such as sand blasting or pressure washing. Poultice techniques will be most appropriate. | **As necessary** |

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