Report to General Manager

Attachments:
1. Condition Assessment Report on the Queen Victoria Jubilee Fountain
2. Bradfield Park Stone Shelters and Civic Park Jubilee Fountain
3. Queen Victoria Jubilee Fountain - Sandstone Shelters Bradfield Park
4. Condition Assessment Report Queen Victoria Jubilee Fountain Civic Centre Park, North Sydney

SUBJECT: Queen Victoria Jubilee Memorial Fountain - Condition Assessment and Proposed Schedule of Works

AUTHOR: Kate Bambrick- Browne, Landscape Grants Coordinator

ENDORSED BY: Rob Emerson, Director Open Space and Environmental Services

EXECUTIVE SUMMARY:

Council commissioned consultants to undertake a condition assessment report on the Queen Victoria Jubilee Memorial Fountain. This report details the findings of that assessment and provides a proposed schedule of works together with a funding breakdown.

FINANCIAL IMPLICATIONS:

$60,000.00 funding for this project is included in the adopted 2014/2015 budget. The additional $17,000.00 necessary to complete all recommended works in Stage One can be achieved through savings within the existing Capital Works budget.

Comment by Responsible Accounting Officer:
Funding for the project is appropriate.

RECOMMENDATION:
1. THAT Council undertakes work in Stage One as identified in the report, following the completion of the appropriate procurement process.
2. THAT Council allocates $68,000.00 towards the redesign and construction of the hydraulic system and equipment pit in the 2016/2017 capital works program.
LINK TO DELIVERY PROGRAM

The relationship with the Delivery Program is as follows:

Direction: 4. Our Social Vitality
Outcome: 4.4 North Sydney's history is preserved and recognised
Direction: 2. Our Built Environment
Outcome: 2.4 North Sydney's heritage is preserved and valued

BACKGROUND

There is no previous report on this item.

A consultant was appointed in late December 2014 to undertake a condition assessment of the Queen Victoria Jubilee Memorial Fountain located in Civic Centre, Miller Street. The assessment has now been completed and the report has been received at Council. It contains a schedule of proposed conservation treatment works that should be implemented to preserve the heritage integrity of the fountain.

CONSULTATION REQUIREMENTS

Community engagement is not required.

SUSTAINABILITY STATEMENT

The following table provides a summary of the key sustainability implications:

<table>
<thead>
<tr>
<th>QBL Pillar</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>● The heritage listed fountain contributes to the urban environment creating a significant feature within the parkland setting.</td>
</tr>
<tr>
<td>Social</td>
<td>● Preservation of an item that has recognised heritage value.</td>
</tr>
<tr>
<td>Economic</td>
<td>● Extensive maintenance works now will prevent devaluation of the item.</td>
</tr>
<tr>
<td>Governance</td>
<td>● Preservation of the 120 year old working fountain that has heritage listing demonstrates Council’s commitment to being a leader and accountable for conservation of items of built heritage in the North Sydney area.</td>
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</tbody>
</table>

DETAIL

Background
The Queen Victoria Jubilee Memorial Fountain (circa 1899) was originally erected in St Leonards Park adjacent to the Bowling Club, to mark the Diamond Jubilee (sixty years) of Queen Victoria’s reign. The fountain remained there in a largely neglected condition until 1982, when it was relocated and restored under the direction of Mayor Ted Mack. It is Item 0902 in Council’s Heritage database.

Sydney Artifacts Conservation was engaged in December 2014 to undertake a condition assessment of the Queen Victoria Jubilee Memorial Fountain. The report has now been completed and contains a schedule of proposed conservation treatment works that should be implemented to preserve the structural and heritage integrity of the fountain.

**Condition Summary**

Extensive research into the history of the fountain shows that it was originally cast using a material called ‘Durete’ a mixture of coke and Portland cement which is then silicated. The fountain was cast in three sections: the lower bowl, plinth and column; the upper bowl and column and; the finial. These three sections are connected by a central ferrous pipe which enables water to reach the top bowl. Spitters (small diameter pipes) located strategically around the perimeter of the two bowls are used to control the water level inside each bowl but blockages have resulted in water discharging over the edges of the bowls with water then running across the underside face of each bowl. Fine cracks within the bowls, combined with the water overflow path, have resulted in calcareous deposits building up across the mouldings.

The structural engineers’ assessment found no signs of structural weakness, however there are cracks in the decorative mouldings around the fountain and signs of extensive erosion associated with the action of the water on the mouldings. The conservation works proposed therefore largely focus on rectifying these issues in order to conserve the existing fabric of the fountain bowls.

A query was also raised in the report about the water levels of the surrounding ponds and their need for compliance with the Swimming Pools Act. However, the water fountain and ponds does not meet the definition of a swimming pool as described within the Act. It is therefore not considered necessary to fence the fountain or reduce the water depths to less than 300mm. In addition, the presence of the fountain and ponds within the park are easily seen and identified from a distance away. It is considered reasonable to anticipate that, within the context of other risks such as the heavily trafficked Miller Street frontage and the presence of stairs, low retaining walls etc, children playing or visiting the park and surrounds are under the responsible supervision of their accompanying carers.

**Hydraulics and Plant Room**

In addition to a condition assessment of the structure of the fountain the consultants also appointed water feature specialists to assess the mechanical and hydraulic components of the fountain. The comprehensive rating system applied to each component essentially indicated that the pit within which the equipment is housed and many of the hydraulic components no longer comply with current technologies or standards. The enclosed entry and space within which the fountain hydraulics are located require substantial upgrading and this may require relocation of the entire pit, with a consequent cost likely to be above $60 000.
However it is suggested that as maintenance works are currently undertaken in-house, by trained Council staff this component of the works can be managed safely with the application of work practices until such time as funding enables the overhaul and rebuilding of the hydraulic system and construction of a new extensive plant room. Priority should be given to conserving the fabric of the fountain and ponds in the first instance.

**Decorative Pigmented Coating**

Investigations have also led the consultants to suggest that the fountain was originally protected by pigmented coating as there are still visible traces of the coating in some areas. Further investigations would be necessary to determine the original scheme however the report recommends redecorating.

**Funding and Staging of the Works**

Council allocated $60 000 towards maintenance works on the fountain in the current budget however these are not sufficient to undertake all the works recommended within the consultant’s report. Therefore it is recommended that priority be given to conservation of the fountain structural components as a priority and works to the hydraulic components be undertaken as a later stage.

Substantial scaffolding will be required around the full height of the fountain to allow surfaces to be examined and treated at close range and to allow in-situ testing of the concrete. Hire and installation costs for scaffolding of this nature are a significant component of the project budget. It is therefore considered more efficient to undertake all work requiring scaffolding within the proposed Stage One of the works. Thus the reapplication of the pigmented coating has been included in this first stage of the works.

Consequently it is suggested the following works be undertaken within Stage One and further stages be undertaken in subsequent financial years as funding is allocated.

<table>
<thead>
<tr>
<th>STAGE ONE summary of costs</th>
<th>estimate</th>
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<td>site establishment, including site fencing</td>
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<td>scaffolding</td>
<td>14330</td>
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<tr>
<td>masonry repairs</td>
<td>15500</td>
</tr>
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<td>cleaning and antifungal treatment application</td>
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<tr>
<td>waterproof membrane to bowls</td>
<td>6000</td>
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<tr>
<td>painting</td>
<td>8900</td>
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<tr>
<td>contingency</td>
<td>5000</td>
</tr>
<tr>
<td><strong>Estimated total</strong></td>
<td><strong>76955</strong></td>
</tr>
</tbody>
</table>

Under Council’s Procurement Policy the project will need to undergo a public quotation process.

Plant Room and Hydraulics Upgrades have been deferred to a second stage and the associated costs are estimated below
Full copies of the condition assessment report and supporting hydraulic and structural engineering assessments are attached to this report for Councillor information.
Condition Assessment Reports
on the
Queen Victoria Diamond Jubilee Fountain (c.1899),
Civic Centre Park, North Sydney
and
Two (2) Sandstone Shelters (1938)
Bradfield Park, North Sydney
for
North Sydney Council

Anne Cummins
January 2015
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Sydney Artefacts Conservation, December 2014
EXECUTIVE SUMMARY

Sydney Artefacts Conservation was engaged in November 2014 by North Sydney Council to carry out condition reporting and to scope conservation treatment works on the following three heritage items; the Queen Victoria Diamond Jubilee Fountain, Civic Centre Park, North Sydney and two sandstone shelters located in Bradfield Park, Kirribilli.

The body of this report contains a summary of the description, condition and proposed treatment works for the three heritage items. The details of each can be found in the relevant specialists report included in the Appendices. The budget estimates for the works have been issued separately.

Queen Victoria Jubilee Memorial Fountain

The Queen Victoria Jubilee Memorial Fountain was originally erected, circa 1899, in St. Leonards Park adjacent to the Bowling Club, to mark Queen Victoria’s Diamond Jubilee (sixty years as Queen). From the 1930s the fountain remained neglected until in 1982 it was relocated and apparently restored to its current location.

The Fountain is in a fair condition given that it has had minimal maintenance over the last 116 years. As a result of the recirculated water system there is a combination of loss of fabric from the decorative mouldings underneath the two bowls and finial, as well as a build-up of calcareous deposits which appear as stalactites on the underside of the bowl and leaching at joins of the marble inscription panels. Cracks are evident on the surface of the decorative moulding and may be contained to the 1982 era yellow mortar repairs. There are no visible signs of any structural cracks in the structure, nor is any of the material around the eroded sections loose or ‘drummy’.

The Queen Victoria Fountain hydraulics are generally in poor condition, with many system components having been in operation for extended periods of time. It is assumed that some components would have been upgraded when the fountain was relocated in 1982, however that puts them at 32 years old now with apparently minimal maintenance during this period. Many elements do not comply with current standards.

Recommendations for its remediation include investigations into the fabric composition and colouring and testing water loss. Works to the historic structure include surface cleaning, mortar repairs to fill the cracks and replication of missing decorative elements and removal of calcareous accretions and repainting. A redesign and upgrading of the hydraulics and plant room are recommended with the addition of an automatic water treatment system.

Stone Shelters, #1 (Northern) and #2 (Southern)

The two sandstone shelters in Bradfield Park were custom built in late1937 to support flood lights on their roofs to illuminate the north side of the Sydney Harbour Bridge (SHB) during the sesquicentenary of colonisation celebrations. Currently only the northern shelter performs this function and has razor wire mounted on the parapet presumably to deter access by trespassers to the lighting installation.

The two shelters were built to a similar design, with the northern shelter at the water’s edge and the southern shelter set back. Solid sandstone ashlar walls support a reinforced concrete roof, with a parapet wall around the perimeter, which is rendered and assumed to be of brick. Each shelter contains a semi-circular arch which is centred on each of the four elevations.

The shelters are in fair condition. There are no signs of any structural movement in the structures and the sandstone is in good condition save for isolated areas of erosion, salt attack and pointing loss. There is a lot of debris on the roofs together
with various plants growing, including a small fig tree growing out of the junction of the roof and parapet on the northern shelter. Pointing is missing from both shelters. Internally the major problem with the shelters is that they are used as urinals, which is eroding and damaging the sandstone due to salt attack from the urine and is clearly visible in each corner of the shelters. The soffits of the concrete roofs are cement rendered and one area on the northern shelter has spalled, exposing rusted reinforcement, due to water leakage from above. It is felt that there is insufficient signage advising the public of free WC facilities nearby. Apart from signage there is little else that could change the habits of the public in this regard given that it is totally impractical to have the buildings monitored 24 hours a day.

Externally the render to the base of the parapet wall on the southern shelter is cracked along its length and is spalling in isolated areas.

The remedial works comprise the following: clearing the roofs of rubbish and plants, removal of razor wire and support frame from northern shelter, removal of interior downpipes, improving the drainage fall of the roofs by addition of cement, mounting the lights of the northern shelter on plinths and installing two new spitters to both shelters to shed water from the roof and application of a membrane to the roof floor and walls. Installation of a cage to cover and protect the electrical and lighting installation on the northern shelter. Cleaning of the stone and parapet walls, preparing and infilling cracks and losses with repair mortar and repointing with lime based masons putty. Desalination of lower interior course to remove urine salts and application of corner covers internally to prevent them being used as urinals. Install signage and directions to adjacent WC facilities.

Acknowledgements

The project team consisted of Anne Cummins, Principal Conservator, Sydney Artefacts Conservation who Project Managed, conducted historical research and collated this report with administrative assistance from Cecilie Knowles. Malcolm Rolls, Chartered Building Engineer from RH Consulting Engineers who reported on the structural components of the three structures and contributed to the scope development and budget estimates (Appendix B). James Ginter, Director, Traditional Stonemasonry (Consulting) P/L, who reported on fabric condition, scope development and creation of annotated drawings and photo montage (Appendix A) with assistance from Nicola Ashurst for scope development of the Queen Victoria Jubilee Fountain. Joshua Almond, Managing Director, Water Features Australia who reported on the condition of the hydraulics, nozzles, water treatment and compliance issues as well as scope development and budget estimates for upgrading the systems (Appendix C).

The team would like to acknowledge assistance from North Sydney Council staff Kate Bambrick-Browne the project coordinator, as well as Library Services staff Ian Hoskins and Shannon Haritos for assistance with historical research.
LOCATION
The Queen Victoria Diamond Jubilee Fountain is located on the eastern side of Civic Centre Park, Miller Street, North Sydney (Fig 1).

The two (2) sandstone shelters are located on the lower parkland of Bradfield Park to the east of the northern pylon of the Sydney Harbour Bridge, Kirribilli (Fig 2).

Fig 1: Location of The Queen Victoria Diamond Jubilee Fountain (circled), Civic Park, North Sydney.

Fig 2: Location of the two sandstone shelters (circled), Bradfield Park, Kirribilli.
DESCRIPTION SUMMARY
Queen Victoria Diamond Jubilee Fountain
The Queen Victoria Jubilee Memorial Fountain is a six metre high, ornate water feature comprised of pre-cast sections of coke-breeze concrete (Fig 3). It consists of a lower hexagonal bowl (2.6 m diameter) and its supporting plinth and column decorated with floral and leaf designs and dragon heads with water spouts; the plainer, upper, hexagonal bowl (1.5 m diameter) is smaller with four animal heads with water spouts and a column above; and is topped with a finial. The interior of the two bowls do not have a waterproof membrane. All sections appear to be secured with a central ferrous pipe which enables water to reach the top of the finial. A horizontal cast iron pipe is evident in the lower bowl which transports water from the central vertical pipe to the eight water jets inside the mouth of the animal heads. Towards the base of the fountain are marble inscription panels following the hexagonal plinth formation with lead lettering explaining that they are the foundation stones laid by the Mayoress in 1897.

The pond is circular shaped comprising four separate bays. Three crescent-shaped bays surround the central circular bay which is lined with a cream coloured waterproof membrane. The coping surrounding the bays is a combination of poured cement and sandstone blocks, the membrane does not cover the sandstone blocks which form part of the internal wall part of the pond (Fig 3).

A total of 16 copper jet nozzles on the fountain supply the display water from the pumping system, with a disturbance line in the centre crescent-shaped bay used to flood the two bays either side. The plant room is set into the concrete coping on the west side. There is currently no incorporated water treatment system (refer to Water Features Australia Pty Ltd, *Condition Assessment Report*, - Appendix C).

The Queen Victoria Jubilee Memorial Fountain was originally erected in St. Leonards Park adjacent to the Bowling Club to mark Queen Victoria’s Diamond Jubilee (sixty years as Queen). The foundation stone was laid by the Mayoress Mrs. Purves at a large gathering of locals and children on 22 June 1897. From the 1930’s the fountain stood neglected at the northern boundary of the Bowling Club. Council files show much correspondence from 1930s-1980s about relocating the fountain, however it was under the direction of Mayor Ted Mack that it was finally relocated in 1982. T. A.
Taylor and Sons relocated it in three sections to the newly landscaped Civic Centre Park where it has remained since.

Research by the author discovered a Sydney Morning Herald article from 19 January 1899 page 4, noted the building contractor, materials of construction of the fountain but not an installation date

“The foundation stone was laid during the Record Reign Demonstration held in the park in June, 1897, by the then Mayoress, Mrs J.M. Purves. Upward of 12 months passed without any further action being taken, but eventually Messers Grant and Cooks of 133 Devonshire street Sydney were entrusted with the work, according to details supplied by them and approved by the local council. The fountain is of durete1 a combination of coke and Portland cement, afterwards silicated.”

In Council’s archives there was a mention of a Scottish company from Glasgow called MacFarlane and Coy putting in a tender for the pre-cast fountain, it remains unclear whether the current fountain was imported in pre-cast form by the successful building contractors.

The Evening News of Wednesday 8 Feb 1899 discussed the fact that there would not be a ceremony for the commissioning of the fountain. The date for its official completion remains unknown, but is assumed to be sometime in 1899.

The fountain appears to be cast in three sections of pre-cast coke-breeze concrete; the lower bowl and its supporting plinth and column; the upper bowl and column and the finial, all secured by a central ferrous pipe which enables water to reach the top. This is based on the historical photographs taken when the fountain was moved to its present location in 1982.

Please refer to drawings 956/NSC/JFSP, 956/NSC/JFN, 956/NSC/JFE, 956/NSC/JFS and 956/NSC/JFW for locations of damaged elements.

Stone Shelters, #1 (Northern) and #2 (Southern)
The two sandstone shelters were custom built in late 1937 to support flood lights to light the north side of the Sydney Harbour Bridge (SHB) during the sesquicentenary celebrations of 1928 to mark the founding of the city of Sydney and the colony of New South Wales. Council correspondence indicates that;

*The masonry structures would serve a dual purpose, the under portion, fitted with seats, etc., would form excellent shelter sheds, the flat roof housing the floodlight units.*

Historical documents indicate there was much discussion between the then Department of Main Roads New South Wales (DMR) and the Municipality of North Sydney, it was agreed and approved that Council would build the masonry walls of the two shelters and the DMR would construct the reinforced concrete roof and parapets.

Correspondence dated 1962 from the DMR to Council requests permission to erect a bank of six floodlights, as was done pre-war on one of the shelter roofs. This was approved by Council with the condition that DMR take responsibility for maintenance. Presumably this was the northern shelter which continues to be used by Roads and Maritime Services NSW to house their flood lighting for the SHB (Fig 11).

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1 Durete is French for tough or hard
2 'Bradfield Park- Floodlighting- Minute No. 56 Parks and Beautification Committee Meeting, 15th September, 1937. Report of Assistant Engineer, Municipality of North Sydney.
3 ‘Letter from Department of Main Roads (37/9026-13/10/37) - proposed construction of masonry floodlight structures at Bradfield Park, Milsons Point.’ Report of Assistant Engineer, Municipality of North Sydney.
4 Letter from Sydney Harbour Bridge Maintenance Office of Department of Main Roads to The Town Clerk, North Sydney Council, 13 September 1962.
The eastern wall of the Northern Shelter (Shelter #1) backs onto the Harbour (Fig 4) while the Southern shelter is set into the park (Fig 5) as shown in the location plan in Fig 2.

The Northern and Southern shelters at Bradfield Park Kirribilli are constructed of ashlar blocks of sandstone laid in a random coursed fashion and presumed to have been bedded in a sand, cement and lime putty mortar most likely used as the original external pointing material.

Each shelter contains a semi-circular arch which is centred on each of the four elevations and would have originally permitted entry and exit from the shelter at each of these arches. Subsequent to the original construction two of the four arches have had infill sandstone walls laid to the sill height which currently restricts entry and exit from two points only.

The sandstone walls are topped by a concrete, reinforced slab of approximately 175mm in thickness which has been set back from the outer alignment of the sandstone wall. The ledge left by this set back has had a cement mortar parging placed onto the stone to allow water to freely run off.

Laid onto the concrete slab are a single skin of bricks onto which has been placed a cement render coating which in some elevations is embellished with a stylised relief of the date of construction ‘1938’ and an Art Deco motif.

The cement render was applied in a single action and covers both the brick parapet walls and the concrete slab edge with no allowance for differential movement.

**Northern Shelter**

The roof of the northern shelter also houses electric lights, which illuminate the harbour bridge, together with all the associated electrical switchgear (Fig 11). The top of the parapet wall of the northern shelter has a flat steel bar running along its length to which is fixed razor wire (Fig 4).

The concrete reinforced roof slab is penetrated on the north east corner internally with a steel pipe. This steel pipe may have been an original storm water discharge pipe however it has been converted into an electrical conduit for the servicing of the spot lights which illuminate the Sydney Harbour Bridge.

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Fig 4: Stone Shelter #1 (Northern), showing its close proximity to the water and parapet razor wire.
CONDITION SUMMARY

Jubilee Fountain

The Queen Victoria Jubilee fountain is in a fair condition. The decorative mouldings on the underside of the bowls shows extensive erosion of the fabric due in part to the action of the fountain water which is presumably exacerbated by wetting and drying cycles (Fig 7). Spitters around the perimeter of the bowls are designed to limit the water level inside the bowls, however four spitters on the lower bowl were blocked at the time of inspection which means that the water level has risen to the very top of the bowls letting the water discharge over the edge of the bowl, with the water then running down the face of the underside of the bowls.

There are some fine cracks to the inside of the bowls and the resultant leakage is showing as a calcareous deposits on the underside of the fabric with the appearance of stalactites (Fig 7). However there are no visible signs of any structural cracks in the structure, nor is any of the material around the eroded sections loose or ‘drummy’.

The original surfaces of the concrete were elaborately detailed as shown in Fig 6. Evidence of the original, smooth compact finish can be seen in many areas as can evidence of the original opaque colour which once covered all the surfaces. There are still visible traces of a pigmented coating that we believe must have covered the entire surface of the monument (see Proposed Treatment Works section). There are localised remnants of a red pigment in recessed areas of the design.

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5 We subsequently unblocked them.
Fig 6: Jubilee Fountain showing extensive erosion to the decorative mouldings on the underside of the lower bowl.

Fig 7: Jubilee Fountain showing erosion, fracturing, lime scale and stalactites on the underside of the lower bowl.

Fig 8: Jubilee Fountain showing erosion cracking and other damage to the top of the finial.

Fig 9: Jubilee Fountain showing orange/red staining on the white marble due to the lead lettering in the inscription.

It is assumed that when the fountain was relocated in 1982, it was also repaired. These repairs are widespread and concentrate on the extremities of detailing. The repair mortar gives the fabric a yellow ochre appearance which is evident now, whereas in the relocation historical images (1982) the surface appeared to be white. These repairs may be what is cracking on the surface and not the original ‘durete’ concrete below.

The top of the finial has been damaged resulting in a loss of its topmost round profile (Fig 8).

The lead lettering on the marble inscription panels has caused an orange/red stain on the white marble\(^6\) (Fig 9). The lead letters which would have originally been flush

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with the marble surface are now in slight relief and the exposed surfaces are oxidised. Some small sections of the lead lettering are missing. There is a build up of redeposited calcareous deposits at the joins of the marble panels.

Please refer to drawings 956/NSC/JFSP, 956/NSC/JFN, 956/NSC/JFE, 956/NSC/JFS and 956/NSC/JFW for locations of the damaged fabric.

**Water Feature Hydraulics**
The Queen Victoria Fountain hydraulics are generally in poor condition, with many system components having been in operation for extended periods of time. It is assumed that some components would have been upgraded when the fountain was relocated in 1982, however that puts them at 32 years old now with apparently minimal maintenance during this period. Many elements do not comply with current standards.

Refer to Appendix C the Water Features Australia Report for the full assessment of the condition of the hydraulic plant and equipment and non-compliance, as well as the water treatment requirements.

**Stone Shelter #1 (Northern)**
The ashlar sandstone walls are exhibiting the first signs of decay in the form of minor exfoliation of the rock faced outer surface and of more severe erosion at the south east corner.

The immediate proximity of the shelter to the salt rich environment of the harbour combined with frequent very high winds will have significantly contributed to the commencement of this decay through migration of soluble salts and drying winds creating cycles of wet and dry that would encourage rapid crystallisation of the salts within the outer crust of the stone.

The pointing material between the ashlar units has generally fared well given the adverse conditions and there is evidence of re-pointing that has taken place in the past.

The concrete slab immediately surrounding the electrical conduit (formerly a water downpipe) in the NE soffit corner is delaminating from corroding reinforcement (Fig 10). It is apparent that the reinforcement was placed originally without sufficient cover (minimum of 40mm) to prevent corrosion, however the proximity of the conduit coupled with a lack of any effective membrane on the roof may have resulted in water leakage promoting corrosion of the steel reinforcement.

Only the northern shelter has the razor wire around the perimeter of the parapet wall (Fig 12) to protect the harbour bridge lighting installation (Fig 11). However, it detracts from the aesthetics and heritage value of the structure and would only appear to offer limited protection from any would be trespassers.

The steel frame supporting the razor wire which is fixed to the top of the parapet walls is corroding along with the fixings embedded into the brick walls. This corrosion is staining the render in iron oxide and the corroding fixings are expanding and cracking the brick walls (Figs 11&12).

Fixed into the upper surface of the roof slab are spot lights which are secured by threaded rods which are embedded into the concrete slab (Fig 11). Generally beneath these lights are evidence of further corrosion growth in the reinforcement. It would seem apparent that the embedment of these rods has potentially supplied the pathway for salt rich water to penetrate the slab and cause this corrosion to begin.

The roof of the northern shelter is drained via two small drainage outlets through the roof slab; one on the SE corner which originally drained down a galvanised pipe, presumably into a stormwater drain. However the pipe is very corroded and broken at
the point two blocks up from the ground, so if water runs through it, it would splash all over the adjacent walls. Another corroded pipe in the SW corner extends a short distance from the roof, so if it was functional would also spray water all over the walls.

The render coating on the outer surfaces of the parapet are faring quite well, whereas the portion covering the concrete slab and in the horizontal zone immediately above the slab have fractured and detached from the substrate. We believe this is attributable to several causes acting both independently and concurrently:

- Water penetration through the base on the brick wall due to insufficient storm water drainage of the roof.
- Water penetration through the base on the brick wall due to an insufficient and/or non-existent membrane on the roof.
- Differential movement between the concrete slab and the brick walls
- Differential movement between the concrete slab and the sandstone walling

There is a small fig tree growing on the northern side of the roof. The roof is littered with organic debris as well as electrical debris such as disused light globes left by the people who maintain the lights (Fig 12).

![Fig 10: Stone Shelter #1 (Northern) showing the steel conduit pipe and damage to surrounding concrete slab.](image)

![Fig 11: Stone Shelter #1 (Northern) showing spotlights, and associated wiring used to illuminate the Sydney Harbour Bridge.](image)

![Fig 12: Stone Shelter #1 (Northern) showing the corroded steel razor wire frame and associated iron oxide staining, fig tree and accumulated refuse.](image)
Stone Shelter #2 (Southern)

The ashlar sandstone walls are in remarkably good condition given its proximity to the harbour water line, however unlike the Northern Shelter it is set back from the harbour and has the benefit of a large tree to provide some respite from the frequent high winds experienced along the harbour foreshore.

The pointing material between the ashlar units has generally fared pretty well given the adverse conditions and there is evidence of re-pointing that has taken place in the past.

The render coating on the outer surfaces of the parapet are faring quite well, where as the portion covering the concrete slab and in the horizontal zone immediately above the slab have fractured and detached from the substrate in localised areas. We believe this is attributable to several causes acting both independently and concurrently:

- Water penetration through the base on the brick wall due to insufficient storm water drainage of the roof.
- Water penetration through the base on the brick wall due to an insufficient and/or non-existent membrane on the roof.
- Differential movement between the concrete slab and the brick walls
- Differential movement between the concrete slab and the sandstone walling

Internally the major problem with the shelters is that they are used as urinals, damaging the sandstone, which is eroding due to salt attack from the urine and clearly visible in each corner of the shelters (Fig 13). It is felt that there is insufficient signage advising the public of free WC facilities nearby. Apart from signage there is little else that could change the habits of the public in this regard given that it is totally impractical to have the buildings monitored 24 hours a day.

The roof of the southern shelter is drained via two openings in the base of the parapet wall which discharges down the face of the sandstone below and into the harbour.

The shelter is partially overhung by a well established Moreton Bay fig tree which drops leaf litter and branches onto the roof of the shelter (Fig 14), which keeps the un-membraned roof damp.

Fig 13: Stone Shelter #2 (Southern) showing urine staining. Both shelters are used internally as urinals.

Fig 14: Stone Shelter #2 (Southern) showing weed growth and accumulated organic plant matter from the overhanging tree.
PROPOSED TREATMENT WORKS
Jubilee Fountain

Please refer to drawings 956/NSC/JFSP, 956/NSC/JFN, 956/NSC/JFE, 956/NSC/JFS and 956/NSC/JFW for locations and further descriptions of the proposed works.

An inspection from scaffolding is essential to determine the final scope of works.

These works will include:

1. The fountain needs to be fully scaffolded so that all surfaces can be inspected at close range. It should be anticipated that localised opening up will be required to determine the exact causes of some defects such as the horizontal cracking which may be caused by rusting reinforcement, and to determine the soundness of other areas. These inspections should determine the works on corroding metalwork in particular. In-situ carbonation testing should be undertaken to establish the condition of the concrete and whether an anti-carbonation treatment should be applied as part of the programme works.

2. Cleaning, to remove loose surface materials including moss and algae. This process should include use of a biocide.

3. The softening and removal of areas of crusted soiling.

4. Removal of built up lime scale and calcium carbonate stalactites.

5. Remove calcareous deposits from marble panels taking care not to disturb the surface of the marble which is similar in composition.

6. It is recommended to take samples of the yellow repair mortar and the underlying original ‘durete material’ to conduct analysis on crushed samples to determine their composition.

7. As the fountain is made of cement based mortar the repair mortars could also be cement based, portions being adjusted as required to make them slightly softer and sacrificial to the fabric of the fountain. Cracks should only be opened up as little as possible to enable a fine-grained repair mortar mixture of hydraulic cement and fine sieved sand to be packed in to an adequate depth.

8. The eroded sections of the fabric should be prepared and replicated in a mortar mixture of hydraulic cement and sand to match original detailing elsewhere on the fountain. A test section is recommended to test adhesion to the surrounding material.

9. It is probable the concrete would benefit from an anti-carbonation coating or a consolidant.

10. The final colour/s should be applied as Keim Mineral Paint (product to be advised). Two coats should be anticipated. Further historic research may have to be undertaken to determine the original colour scheme by looking into archival records as well as careful observation during the initial cleaning phases.

11. The inside of the two bowls should be waterproofed using a liquid membrane. A water based epoxy primer and two coats of water based urethane are recommended.

12. Re-lead the missing lead letters from the marble inscription.

13. Red/orange staining to the marble plaques although unsatisfactory in appearance is, in our opinion, not able to be successfully removed without seriously compromising the marble surface and should therefore not be attempted unless a positive outcome is assured. The marble is to be surface cleaned and the red staining can be camouflaged by selective over-painting if required.
14. Such an elaborately sculpted monument such as this would have originally been quite heavily decorated and for this reason we have recommended a redecoration to the final conserved fountain.

**Water Feature Hydraulics**

Our recommendation would be to redesign and resize a plant room that will accommodate the necessary equipment required to make this feature maintenance-friendly and enable safe access for Council employees and/or contractors. The plant room should be double the size of the existing plant room and extend out into the grass area to the west of the current plant room. Exact measurements and dimensions would need to be investigated during the design phase.

A redesign of this system should take into consideration the following:

15. Large capacity filtration that minimises service visits or plant room access visits.
17. Electrical control panel that incorporates adjustable timers, pump protection, wind sensor and electrical safety.
18. The redesign of debris screens and lint strainers.
19. Conduct tests to determine if there are any defects in the internal pipe work which may be causing water leaks through the concrete at various locations.
20. Jet nozzle flow rate adjustments to ensure that there is no ‘overflow’ over the bowls.
21. Repair spitters as required and ensure they protrude below the level of the underside of the bowls by at least 10mm to ensure that water can’t migrate, via capillary action, back up to the structure.
22. Automatic chemical dosing (e.g. peroxide) and sanitisation suitable for existing sculpture pipe work and compatible with the heritage fabric.
23. A plant room that is safely accessible by employees/contractors.
24. Plant room access lids and weight of lids.
25. Plant room mechanical ventilation.
27. Plant room access ladder with extendable handles.
28. Reducing the operating depths for each of the pond bays. Concrete topping to all pond floors to make operating depth 300mm maximum. Current depth varies between 370-450mm.

**Stone Shelter #1 (Northern)**

Please refer to drawings 956/NSC/S1.1 and 956/NSC/S1.2 for locations and further descriptions of the proposed works.

1. Remove the razor wire from the roofs of the northern shelter.
2. Remove the steel bar from the top of the parapet walls of the northern shelter.
3. Remove all rubbish from the roofs.
4. Poison the fig tree on the roof of the northern shelter and once dead remove.
5. Remove all plants from the roofs.
6. Apply a suitable herbicide to the foliage growing from the existing mortar joints as indicated. Once the plants are dead, remove all plant matter from the joints where practicable and re-point the joints affected by the removal.

7. Wash the internal and external sandstone walls by hand using low pressure fresh water and nylon scrubbing brushes.

8. Supply and install a Westox ‘Cocoon’ poultice to the base courses of stone works to desalinate as indicated on the drawings. The thickness of the coating shall be 10mm. Leave the poultice in place protected from inclement weather for a period of two weeks. Remove the poultice and discard off site. Vacuum the surface of the stone and apply a second course of poultice leaving this course on for a further two weeks. Once the removed wash the stone with low pressure clean fresh water until all signs of the poultice has been successfully removed.

9. Carefully cut out and replace damaged render in locations marked on drawings.

10. Core out ferrous pins and inclusions in renderer brickwork and patch in compo mortar.

11. Remove all redundant extraneous metal from the face of the sandstone and make good with compo mortar.

12. Carefully form two roof drainage outlets to southern elevation by coring 2 x 100mm diameter holes as shown on the drawings for the insertion of UPVC storm water spitters. Line the outlet with code 5 lead including a spout to discharge the rainwater clear of the sandstone under.

13. Carefully remove the old cement mortar parging to the top course of the stone external walls and replace with new cement mortar parging using a mix of 6 parts clean sharp ‘Sydney’ Sand, 1 part Portland cement and 1 part slaked lime putty. Make good to all areas of defective cement render to the parapet walls.

14. Provide an angled cement fillet at the base of the parapet walls to ensure water does not lay on the over-sailing part of the concrete roof.

15. Form and pour new concrete plinths as mounts for the existing spotlights and new protective cages.

16. Fabricate grade 316 stainless steel base plates for the spotlights and fix to same. Set aside for remounting.

17. Disconnect and remove all electrical switchgear from the face of the parapet wall and set aside for remounting- to be coordinated with Department of Roads and Maritime Services.

18. Clean the roof slab, prepare the surface and install a 30 - 50mm cement topping slab to fall towards the new storm water outlets.

19. Supply and install a new membrane system to line the roof surface and the internal faces of the parapet walls including the top faces with a suitable elastomeric single ply membrane, as indicated in the drawing. Ensure a watertight connection to the new UPVC spitters.

20. Remount all lights on their new plinths. Reinstate the spotlights on the membrane clad plinths, using stainless steel fixings, ensuring the membrane system is not compromised in any way.

21. Remount all electrical switchgear onto face of parapet wall using stainless steel fixings.

22. Supply and install new 316 grade stainless steel lockable security frame and screen mounted onto the existing parapet wall using stainless steel fixings, to ensure that no unauthorised access to the electrical and lighting installation on
the roof is possible. The frame is to be designed to suit all governing authorities and shall be the subject a future design.

23. The area of spalled concrete to the soffit of the northern shelter should be hacked back to sound material and also to a point where the steel reinforcement is in an acceptable condition.

24. Treat the steel reinforcement with a rust convertor and make good with an approved epoxy repair system.

25. Remove the galvanised roof drainage pipes from the roof together with the rusted conduit pipe and make good the resultant holes.

26. Replace sandstone ashlar walling to a minimum depth of 100mm in thickness. Stone is to be grade A quality free from any blemishes and is to match the colour, banding, density and porosity of the existing sandstone.

27. Retool sandstone where indicated by scraping away loose and friable stone from the surface of the rock faced stone. Avoid leaving any discernible marks on the stone surface.

28. Repoint internal and external sandstone walls where necessary with a lime based masons mortar mix comprising 3 parts washed sharp sand, 1 part slaked lime, ¼ part metakaolin.

29. Supply and install new 316 grade stainless steel corner covers, approximately 1200mm high, with a non-directional finish, diagonally across each of the four corners of the internal walls of the shelter to protect stone from urine. The corner covers are to be designed in such a manner as to ensure that they:
   - are fixed to the walls via tabs that are placed so that they align with existing mortar joints
   - have no level surfaces onto which items can be placed
   - junctions between stainless steel and stone are sealed using a non-silicone based elastomeric sealant.

**Stone Shelter #2 (Southern)**

Please refer to drawings 956/NSC/S2.1 and 956/NSC/S2.2 for locations and further descriptions of the proposed works.

1. Remove all rubbish from the roofs.

2. Apply a suitable herbicide to the foliage growing from the existing mortar joints and on roof. Once the plants are dead, remove all plant matter from the joints where practicable and re-point the joints affected by the removal.

3. Remove all plants from the roofs.

4. Wash the internal and external sandstone walls by hand using low pressure fresh water and nylon scrubbing brushes.

5. Supply and install a westox 'Cocoon' poultice to the base courses of stone works to desalinate as indicated on the drawings. The thickness of the coating shall be 10mm. Leave the poultice in place protected from inclement weather for a period of two weeks. Remove the poultice and discard off site. Vacuum the surface of the stone and apply a second course of poultice leaving this course on for a further two weeks. Once the removed wash the stone with low pressure clean fresh water until all signs of the poultice has been successfully removed.

6. Carefully cut out and replace damaged render in locations marked on drawings.
7. Core out ferrous pins and inclusions in rendered brickwork and patch in compo mortar.

8. Remove all redundant extraneous metal from the face of the sandstone and make good.

9. Carefully form two roof drainage outlets to southern elevation by coring 2 x 100mm diameter holes as shown on the drawings for the insertion of UPVC storm water spitters. Line the outlet with code 5 lead including a spout to discharge the rainwater clear of the sandstone under.

10. Carefully remove the old cement mortar parging to the top course of the stone external walls and replace with new cement mortar parging using a mix of 6 parts clean sharp 'Sydney' Sand, 1 part Portland cement and 1 part slaked lime putty. Make good to all areas of defective cement render to the parapet walls.

11. Provide an angled cement fillet at the base of the parapet walls to ensure water does not lay on the over-sailing part of the concrete roof.

12. Clean the roof slab, prepare the surface and install a 30 - 50mm cement topping slab to fall towards the new storm water outlets.

13. Supply and install a new membrane system to line the roof surface and the internal faces of the parapet walls including the top faces with a suitable elastomeric single ply membrane, as indicated in the drawing. Ensure a watertight connection to the new UPVC spitters.

14. Remove the galvanised roof drainage pipes from the roof together with the rusted conduit pipe and make good the resultant holes.

15. Repoint internal and external sandstone walls where necessary with a lime based masons mortar mix comprising 3 parts washed sharp sand, 1 part slaked lime, ¼ part metakaolin.

16. Supply and install new 316 grade stainless steel corner covers, approximately 1200mm high, with a non-directional finish, diagonally across each of the four corners of the internal walls of the shelter to protect stone from urine. The corner covers are to be designed in such a manner as to ensure that they:

- are fixed to the walls via tabs that are placed so that they align with existing mortar joints
- have no level surfaces onto which items can be placed
- junctions between stainless steel and stone are sealed using a non-silicone based elastomeric sealant.
APPENDICES

Appendix A
Bradfield Park Stone Shelters and Civic Park Jubilee Fountain,
Recommended Scope of Works
Prepared by James Ginter, Director, Traditional Stonemasonry
(Consulting) Pty Ltd

Appendix B
Engineers Letter, Queen Victoria Jubilee Fountain – Sandstone Shelters
Prepared by Malcolm Rolls, Chartered Building Engineer, RH Consulting
Engineers, Specialist Civil & Structural Engineering Services

Appendix C
Condition Assessment Report, Queen Victoria Diamond Jubilee
Fountain, Civic Centre Park, North Sydney
Prepared by Joshua Almond, Managing Director, Water Features
Australia Pty Ltd
Bradfield Park Stone Shelters and Civic Park Jubilee Fountain
Recommended Scope of Works

Anne,

Please find below our 'Draft' recommendations for the scope of works to each of the monuments listed.

Bradfield Park

Condition Report Northern & Southern Shelter

Generally

The Northern and Southern shelters at Bradfield Park Kirribilli are constructed of ashlar blocks of sandstone laid in a random coursed fashion and presumed to have been bedded in a sand, cement and lime putty mortar with a sand and lime putty mortar most likely used as the original external pointing material.

Each shelter contains a semi-circular arch which is centred on each of the 4 elevations and would have originally permitted entry and exit from the shelter at each of these arches. Subsequent to the original construction two of the four arches have had infill sandstone walls laid to the sill height which currently restricts entry and exit from two points only.

The sandstone walls are topped by a concrete, reinforced slab of approximately 175mm in thickness which has been set back from the outer alignment of the sandstone wall. The ledge left by this set back has had a cement mortar parging placed onto the stone to allow water to freely run off.

Laid onto the concrete slab are a single skin of bricks onto which has been placed a cement render coating which in some cases is embellished with a stylised relief of the date of construction and an Art Deco motif.

The cement render was applied in a single action and covers both the brick parapet walls and the concrete slab edge with no allowance for differential movement.
Northern Shelter

The ashlar sandstone walls are exhibiting the first signs of decay in the form of minor exfoliation of the rock faced outer surface and of more severe erosion at the South East corner.

The immediate proximity of the shelter to the salt rich environment of the harbour combined with frequent very high winds will have significantly contributed to the commencement of this decay through migration of soluble salts and drying winds creating cycles of wet and dry that would encourage rapid crystallisation of the salts within the outer crust of the stone.

The pointing material between the ashlar units has generally fared pretty well given the adverse conditions and there is evidence of re-pointing that has taken place in the past. As the pointing material is one of the first lines of defence against salt crystallisation in stone it is advisable to review the condition of the pointing material and replace with new lime mortar during any conservation exercise.

The concrete reinforced roof slab is penetrated on the North East corner internally with a steel pipe. This steel pipe may have been an original storm water discharge pipe however it has been converted into an electrical conduit for the servicing of the spot lights which illuminate the Sydney Harbour Bridge. The concrete slab immediately surrounding this conduit is suffering from corroding reinforcement. It is apparent that the reinforcement was placed originally without sufficient cover (minimum of 40mm) to prevent corrosion, however the proximity of the conduit coupled with a lack of any effective membrane on the roof has caused this corrosion to begin.

Fixed into the upper surface of the roof slab are spot lights which are secured by threaded rods which are embedded into the concrete slab. Generally beneath these lights are evidence of further corrosion growth in the reinforcement. It would seem apparent that the embedment of these rods has potentially supplied the pathway for salt rich water to penetrate the slab and cause this corrosion to begin.

The render coating on the outer surfaces of the parapet are faring quite well where as the portion covering the concrete slab and in the horizontal zone immediately above the slab have fractured and detached from the substrate. We believe this is attributable to several causes acting both independently and concurrently:

- Water penetration through the base on the brick wall due to insufficient storm water drainage of the roof.
- Water penetration through the base on the brick wall due to an insufficient and/or non-existent membrane on the roof.
- Differential movement between the concrete slab and the brick walls
- Differential movement between the concrete slab and the sandstone walling

The steel frame supporting the razor wire which is fixed to the top of the parapet walls is corroding along with the fixings embedded into the brick walls. This corrosion is staining the render in iron oxide and the corroding fixings are expanding and cracking the brick walls. Removal of these corroding steel elements is critical to ensure the future integrity of the brick parapet walls.

**Proposed Works - Northern Shelter**

Please refer to drawings 956/NSC/S1.1 and 956/NSC/S1.2 for locations and further descriptions of the proposed works.

- Carefully cut out and replace damaged render in locations marked on drawings.
• Carefully remove the old cement mortar parging to the top course of the stone external walls and replace with new cement mortar parging using a mix of 6 parts clean sharp ‘Sydney’ Sand, 1 part Portland cement and 1 part slaked lime putty.

• Replace sandstone ashlar walling to a minimum depth of 100mm in thickness. Stone is to be grade A quality free from any blemishes and is to match the color, banding, density and porosity of the existing sandstone.

• Retool sandstone where indicated by scraping away loose and friable stone from the surface of the rock faced stone. Avoid leaving any discernable marks on the stone surface.

• Apply a suitable herbicide to the foliage growing from the existing mortar joints as indicated. Once the plants are dead, remove all plant matter from the joints where practicable and re-point the joints affected by the removal.

• Supply and install a westox ‘Cocoon’ poultice to the base courses of stone works as indicated on the drawings. The thickness of the coating shall be 10mm. Leave the poultice in place protected from inclement weather for a period of two weeks. Remove the poultice and discard off site. Vacuum the surface of the stone and apply a second course of poultice leaving this course on for a further two weeks. Once the removed wash the stone with low pressure clean fresh water until all signs of the poultice has been successfully removed.

• Core 2 x 100mm diameter holes as shown on the drawings for the insertion of UPVC storm water spitters.

• Carefully remove and dispose of the existing razor wire coils and rusting steel support frame surmounting the parapet wall. Ensure all ferrous fixings are removed and the holes patched in compo mortar.

• Temporarily disconnect the existing lights and set to one side.

• Clean the roof slab, prepare the surface and install a 30 - 50mm topping slab to fall towards the new storm water outlets.

• Pour two new concrete plinths for the re-mounting of the existing spotlights.

• Supply and install a new membrane system as indicated in the drawing ensure a watertight connection to the new UPVC spitters.

• Reinstall the spotlights on the membrane clad plinths ensuring the membrane system is not compromised in any way.

• Supply and install new 316 grade stainless steel lockable security frame and screen mounted onto the existing parapet wall, to ensure that no unauthorised entry to the roof is possible. The frame is to be designed to suit all governing authorities and shall be the subject a future design.

• Supply and install new 316 grade stainless steel corner covers with a non-directional finish to each of the four corners of the internal walls of the shelter. The corner covers are to be designed in such a manner as to ensure that they:
  - are fixed to the walls via tabs that are placed so that they align with existing mortar joints
  - have no level surfaces onto which items can be placed
  - junctions between stainless steel and stone are sealed using a non-silicone based elastomeric sealant.

**Southern Shelter**

The ashlar sandstone walls are in remarkably good condition given its proximity to the harbour water line however unlike the Northern Shelter it is set back off the harbour and has the benefit of a large tree to provide some respite from the frequently high winds experienced along the harbour foreshore.

The pointing material between the ashlar units has generally fared pretty well given the adverse conditions and there is evidence of re-pointing that has taken place in the past. As the pointing material is one of the first lines of defence against salt crystallisation in stone it is advisable to review the condition of the pointing material and replace with new lime mortar during any conservation exercise.
The concrete reinforced roof slab is penetrated on the North East corner internally with a steel pipe. This steel pipe may have been an original storm water discharge pipe however it has been converted into an electrical conduit for the servicing of the spot lights which illuminate the Sydney Harbour Bridge. The concrete slab immediately surrounding this conduit is suffering from corroding reinforcement. It is apparent that the reinforcement was placed originally without sufficient cover (minimum of 40mm) to prevent corrosion, however the proximity of the conduit coupled with a lack of any effective membrane on the roof has caused this corrosion to begin.

The render coating on the outer surfaces of the parapet are faring quite well where as the portion covering the concrete slab and in the horizontal zone immediately above the slab have fractured and detached from the substrate. We believe this is attributable to several causes acting both independently and concurrently:

- Water penetration through the base on the brick wall due to insufficient storm water drainage of the roof.
- Water penetration through the base on the brick wall due to an insufficient and/or non-existent membrane on the roof.
- Differential movement between the concrete slab and the brick walls
- Differential movement between the concrete slab and the sandstone walling

**Proposed Works - Southern Shelter**

Please refer to drawings 956/NSC/S2.1 and 956/NSC/S2.2 for locations and further descriptions of the proposed works.

- Carefully cut out and replace damaged render in locations marked on drawings.
- Carefully remove the old cement mortar parging to the top course of the stone external walls and replace with new cement mortar parging using a mix of 6 parts clean sharp 'Sydney' Sand, 1 part Portland cement and 1 part slaked lime putty.
- Supply and install a westox 'Cocoon' poultice to the base courses of stone works as indicated on the drawings. The thickness of the coating shall be 10mm. Leave the poultice in place protected from inclement weather for a period of two weeks. Remove the poultice and discard off site. Vacuum the surface of the stone and apply a second course of poultice leaving this course on for a further two weeks. Once the removed wash the stone with low pressure clean fresh water until all signs of the poultice has been successfully removed
- Core 2 x 100mm diameter holes as shown on the drawings for the insertion of UPVC storm water spitters.
- Clean the roof slab, prepare the surface and install a 30 - 50mm topping slab to fall towards the new storm water outlets.
- Supply and install a new membrane system as indicated in the drawing ensure a watertight connection to the new UPVC spitters.
- Supply and install new 316 grade stainless steel corner covers with a non-directional finish to each of the four corners of the internal walls of the shelter. The corner covers are to be designed in such a manner as to ensure that they:
  - are fixed to the walls via tabs that are placed so that they align with existing mortar joints
  - have no level surfaces onto which items can be placed
  - junctions between stainless steel and stone are sealed using a non-silicone based elastomeric sealant.
Jubilee Fountain - Civic Park North Sydney

Please refer to drawings 956/NSC/JFSP, 956/NSC/JFN, 956/NSC/JFE, 956/NSC/JFS and 956/NSC/JFW for locations and further descriptions of the proposed works.

The fountain is comprised of sections of pre-cast coke-breeze concrete secured by a central ferrous core. So far it has only been inspected at arm’s length from ground level. Nevertheless important details of its materials, construction and condition can be seen.

The defects and weathering that the fountain is exhibiting are to be expected of a construction of this type: a working fountain in excess of 120 years old.
The original surfaces of the concrete were elaborately detailed. The original smooth compact finish can be seen in many areas as can evidence of the original opaque colour which once covered all the surfaces. This photograph shows an area which is particularly complete in surface finish and details. There are still visible traces of a pigmented coating that we believe must have covered the entire surface of the monument. Such an elaborately sculpted monument such as this would have originally been quite heavily decorated and for this reason we have recommended a redecoration to the final conserved fountain. Further research may have to be undertaken to determine the original colour scheme by looking into archival records as well as careful observation during the initial cleaning phases.

The fountain has been relocated and at that time repaired. These repairs are widespread and concentrate on the extremities of detailing.
The pattern of fracturing to certain areas, for example, the cantilevered bowl, suggests corroding reinforcement within the concrete. This bowl has been leaking through fractures for some time as indicated by the lime scale and stalactites to its soffit.

The fountain needs to be fully scaffolded so that all surfaces can be inspected at close range. It should be anticipated that localised opening up will be required to determine the exact causes of some defects such as the horizontal cracking which we suspect may be caused by rusting reinforcement, and to determine the soundness of other areas. These inspections should determine the works on corroding metalwork in particular. In-situ carbonation testing should be undertaken to establish the condition of the concrete and whether an anti-carbonation treatment should be applied as part of the programme works.

The scaffold inspection is essential to determine the final scope of works. These works will include:

- Cleaning, to remove loose surface materials including moss and algae. This process should include use of a biocide.
- The softening and removal of areas of crusted soiling. Hopefully these crusts will be gypsum based and therefore water soluble.
- Removal of built up lime scale and calcium carbonate stalactites.
- The preparation and filling of cracks. Cracks should only be opened up as little as possible to enable a fine-grained repair mortar to be packed in to an adequate depth.
- The preparation of areas of missing detail and their replication in mortar to match original detailing elsewhere on the fountain.
  - As the fountain is made of cement based mortar the repair mortars could also be cement based, with the lime constituent and the aggregate portion being adjusted as required.
- Areas of deep surface loss could be made good to reinstate surface details and to protect the concrete of the core of the block being deeply saturated.
- It is probable the concrete would benefit from an anti-carbonation coating or a consolidant.
- The final colour/s should be applied as Keim Mineral Paint (product to be advised).
  - Two coats should be anticipated.

A high standard of workmanship will be required for all the above works to ensure the minimum amount of original material is lost or compromised.

There still remains need to rectify any defects in the internal pipe work which is at present causing water leaks through the concrete at various locations. (refer to Photo below)
Red/orange staining to the marble plaques although unsatisfactory in appearance is, in our opinion, not able to be successfully removed without seriously compromising the marble surface and should therefore not be attempted unless a positive outcome is assured.

An extract from an APT Bulletin published in 2010 is included below for further reading on the subject.

Orange lead oxide staining of marble

**Causes of Lead Staining**

A search of the literature found that staining of marble from lead was far from unknown in the past. In 1925, for example, the Vermont Marble Company warned against the use of lead in a promotional publication, *The Book of Vermont Marble: A Reference for Architects and Builders*, with this statement: “If cushions have to be used under heavy pieces, these should be of block tin or zinc. Lead is the material often used, but our experience has been that under certain conditions this causes stains.”

Although the company supplied marble for the Memorial Amphitheater and published two photographs of the building in the book, apparently its advice was unheeded by the architects or builders. In terms of laboratory research in this area, F. L. Brady’s 1934 publication by the Building Research Board in England is seminal.

Brady focused on the important role of alkaline mortars in producing lead corrosion, especially those containing portland cement. His tests showed that portland cement produced much more severe corrosion than high-alumina cement and lime mortar. Fresh portland cement typically produces pH values up to 13.5, increasing the dissolution of lead substantially more than saturated lime water, with a pH of 12.5.

Portland-cement mortar is a likely factor in staining on the amphitheater, although the composition of the original mortar is unknown. Both the hardness of the present mortar and the analysis of a mortar sample indicate that portland cement is a major component of mortar used during pointing work done in 1996. The close proximity of mortar containing portland cement to lead located in joints should facilitate staining. A related example is the bright orange-red staining on the pedestal of the equestrian monument in Copenhagen noted in the introduction. It appeared only after the original gap between the marble facing and the pedestal’s core was filled with alkaline hydraulic mortar.

Moisture is critical for the formation of stains as the vehicle for dissolving lead and distributing lead ions and compounds. Stone would have been more exposed to rainwater during construction and prior to cleaning, re-roofing, and re-pointing of the Memorial Amphitheater by EYP in 1996; moisture penetration in the building is reported to have been a serious problem.

Water washing in attempts to keep the building pristine may also have served to increase colored stains. The association of moisture and lead staining on the building is demonstrated by type 1 and 6 stains: they are located on horizontal surfaces with significant water runoff or in areas where water would collect. Heavy deposition of colored compounds on more deteriorated vertical surfaces of the paving
blocks between columns may also be related to greater moisture retention in those areas. Even when the rest of the building appears dry, water runs down vertical surfaces below the lead-coated membrane under viewing boxes, creating the type 4 stains. Marble itself may play a role in staining because of the way its fine pores retain moisture: lead-based staining has not been re-ported on limestone, which is more porous. It is probably not a coincidence that a number of examples of lead staining are found in Washington, D.C., which is noted for its high humidity. For example, excess moisture is clearly present on the dome of the District of Columbia World War I Memorial, evidenced by the presence of signifi-cant amounts of black biological material along with lead-containing red stains. Similar black deposits on the Tripoli Monument were already visible in a historic photograph taken before 1860 (when the monument was at the U.S. Capitol), and black biological staining is present today, despite recent cleaning.

Prevention of Lead Staining

Leak, high alkalinity, and water are essential for the formation of lead-derived stains on marble, and staining can be prevented in the absence of any of these elements. Minimizing them will also slow the rate of formation of stains. In marble construction, materials other than lead should be used for plumbing, cushioning or shimming stone, waterproofing membranes, corrosion-prevention for iron, and setting bronze. When lead is present and can-not be removed, use of lime-based mortar is advisable for re-pointing, since the higher alkalinity of portland-cement mortar contributes to the dissolution of lead and formation of colored stains. Reasonable efforts should be made to avoid exposure of monuments to excess water if lead is known to be present.

Removal of Lead-based Colored Stains

The prognosis for removal of colored stains from white marble is poor, be-cause lead oxides are relatively stable. The most highly colored oxides are insoluble at pHs between about 5 and 10, requiring marble-damaging acidic or extremely alkaline solutions to dissolve them. Clorox bleach, which photographs reveal was tested on the corner post at the Memorial Amphitheater, was clearly ineffective. Indeed, bleach could be harmful, since it tends to render the environment more oxidizing, which would enhance the stability of the lead oxides. Other popular marble cleaning agents, such as hydrogen peroxide (H₂O₂), another powerful oxidizer and ammonium citrate solutions, also proved ineffective in this testing. The most promising avenue for further investigation would be research into the transformation of colored to white compounds, as seems to have occurred on the singular block de-scribed in the type 3 stain section. At present, disguising the stains by over-painting or replacement are the only alternatives in the case of severe lead staining.

Conclusion

Red, yellow, and brownish purple “stains” on white Vermont marble were definitively found to consist of lead compounds at the Memorial Amphitheater at the Arlington National Cemetery and other monuments in the greater Washington, D.C., area. Use of a portable X-ray fluorescence unit proved particularly useful in determining that lead was present on stained marble in situ. Minium and litharge were identified by X-ray diffraction analysis of samples taken from the monument, and minium was also found using Raman spectroscopy in the laboratory. Other methods for identification of lead, such as micro-chemical tests, can also be successful. Prevention of staining requires elimination of any of the elements necessary for its formation: excess water, lead, and high alkalinity, such as that produced by portland-cement mortar. Methods of remediation are unlikely to be successful, beyond over painting or replacement of stone.

CAROL A. GRISSOM has been senior objects conservator at the Smithsonian since 1984 in the unit now known as the Museum Conservation Institute. She holds an MA in art conservation from Oberlin College and has published articles on stone cleaning and consolidation. She can be reached at grissomc@si.edu.CLAIRE GERVAIS is a visiting scientist at the Smithsonian’s Museum Conservation Institute. She holds a PhD in chemistry from the University of Rouen in France and held post-doctoral fellowships at Bern University in Switzerland and the University of Georgia. She can be reached at gervais.claire@gmail.com.NICOLE C. LITTLE is a physical scientist at the Smithsonian’s Museum Conservation Institute. She received her MA and BA degrees from the University of Missouri at Columbia. Her research interests include the use of XRD and LA-ICP-MS in the study of cultural materials. She can be reached at littlen@si.edu.GENEVIEVE BIENIOSEK was a pre program intern in conservation at the Smithsonian’s Museum Conservation Institute in 2009-2010, and she is a member of the Buffalo State College Art Conservation Department’s class of 2013. She can be reached at gbieniosek@gmail.comROBERT J. SPEAKMAN is a physical scientist and the head of technical studies at the Smithsonian’s Museum Conservation Institute. His research interests include the application of ICP-MS, XRF, and neutron activation analysis to the study of cultural materials. He can be reached at speakmanj@si.edu.

Acknowledgments

The authors thank Museum Conservation Institute staff members and interns: Robert J. Koesteller, director, and Paula De Priest, deputy director, for their expertise on biological matters; Elise Caoua, Colby Phillips, and Victoria Florey, who performed the XRF analyses; Judy Watson for SEM-EDS analyses; Odile Madden for Raman spectroscopy; Fabien Pottier for X-ray diffraction analyses; and Melvin Wachowiak for ICPM. Thanks also to Richard A. Livingston for insights on Pourbaix diagrams, to Judy Jacob for drawing our attention to the EVP report, and to A. Elena Charola for comments on the paper.

Notes
Art, Biology, and Conservation: Biodeteriora-tion of Works of Art


12. Realini and Sorlini.


Should you have any questions please do not hesitate to call me on 0412 445 558.

Sincerely,

The Traditional Restoration Company P/L

James Ginter
Director
Dear Anne Cummins

RE: Queen Victoria Jubilee Fountain – Sandstone Shelters Bradfield Park

On 8th December 2014 Mr Malcolm Rolls visited the above sites and met with Anne Cummins, James Ginter and Joshua Almond. The purpose of the visit was to assess the condition of the three heritage items.

**Queen Victoria Jubilee Fountain**

The fountain was erected in St. Leonards Park adjacent to the Bowling Club sometime after 1897, where it stayed until 1982 when it was moved to its present location. To the best of our knowledge it was cast using a material called ‘Durete’ a mixture of coke and Portland cement which was then silicated. The fountain appears to be cast in three sections the lower bowl and its supporting plinth and column, the upper bowl and column and the finial. These facts are based on the historical photographs taken when the fountain was moved to its present location.

Examination of the decorative mouldings on the underside of the bowls shows extensive erosion of the fabric due in part to the action of the fountain water on the same. Spitters around the perimeter of the bowls are designed to limit the water level inside the bowls but it was noted that several of the spitters are either fully or partially blocked which means that the water level has risen to the very top of the bowls letting the water discharge over the edge of the bowl, with the water then running down the face of the underside of the bowls. It was also noted that there are some fine cracks to the inside of the bowls and the resultant leakage is showing as a calcareous deposit on the fabric. However there are no visible signs of any structural cracks in the structure nor is any of material around the eroded sections loose or ‘drummy’. The eroded sections should therefore be made good using a compatible material. A test section is recommended to test adhesion to the surrounding material. It is important that the repair material is weaker than original material so that if further erosion takes place in the future, the new material would be sacrificial.

It is also important to ensure that there is no leakage from the two bowls of the fountain and that the overflows or spitters work as intended and don’t allow water to migrate over the surface of the structure.
A subsequent inspection of the fountain, whilst the fountain was operating, confirmed that the spitters are on the bowls partially working. It was also noted that there is a vast difference in the flow rates of the individual spitters. It is imperative that the internal water level is kept below the rim level to prevent overspill and to this end it will be necessary to carry some experimentation with the diameter of the spitters to ensure that the bowls don’t overspill. It is also important that the spitters protrude below the level of the underside of the bowls by at least 10mm to ensure that water can’t migrate, via capillary action, back up to the structure. It might also be necessary to adjust the flow of the water to the fountain to ensure that there is no ‘overflow’, whether this could be achieved electronically via a sensor within the bowls, would need further investigation.

To prevent any leakage from within the structure of the bowls we would recommend that a waterproof membrane be applied to the inside surface of the two bowls.

Evidence exists that the fountain had been previously painted and should it be decided that it will be repainted then a lime based paint would undoubtedly help protect the structure acting as a shelter coat.

During the inspection weight was applied to the outside of the lower bowl to view the condition of the internal surface. No movement was observed during this exercise. We are therefore of the opinion that there are no structural problems apparent at this time and that once all repairs and remedial works have been carried out and that any maintenance schedules are adhered to then we are confident that the fountain should give many more years of service.

Conclusion

1. The eroded sections of the fabric should be repaired as noted above.
2. The inside of the bowls should be waterproofed using a liquid membrane. A water based epoxy primer and two coats of water based urethane are recommended.
3. The spitters should be cleaned to ensure full water flow and repaired where necessary.
4. The fountain be painted with a lime based paint that would act as a sacrificial shelter coat as well as for decorative reasons.

Sandstone Shelters – Bradfield Park

There are two shelters of similar design situated close to the waters edge, both built to a similar design in 1938. Solid sandstone walls support a reinforced concrete roof, with a parapet wall around the perimeter, which is rendered and assumed to be of brick. The walls that back onto the harbour have large arched window openings as have the walls facing it whereas the two end walls have large arched openings to give pedestrian access to the inside. There are no signs of any structural movement in the structure and the sandstone is in good condition save for isolated areas of pointing, erosion and salt attack.

The roof has a parapet wall around the perimeter which together with the over-sailing section of the roof is cement rendered. There is a lot of debris on the roof together with various plants growing out of the same, a small fig tree is growing out of the junction of the roof and parapet on the northern shelter. The roof of the northern shelter also houses electric lights, which illuminate the harbour bridge, together with all the associated electrical switchgear. The top of the parapet wall of the northern shelter has a flat steel bar running along its length to which is fixed razor wire. It was noted that all the steelwork is rusted to different degrees.

Given that it is only the northern shelter that has the razor wire around the perimeter of the parapet wall it seems safe to assume that it is there to protect the harbour bridge lighting installation. However it detracts from the aesthetics and heritage value of the structure and would only appear to offer limited protection.
from any would be trespassers. As noted above the supporting structure is causing damage to the parapet wall. We are of the opinion that the electrical and lighting installation would be better protected by installing lockable stainless steel cages over the items which would be fixed onto of the proposed raised plinths on top of the concrete roof.

Internally the major problem with the shelters is that they are used as urinals, damaging the sandstone, which is eroding due to salt attack from the urine and clearly visible in each corner of the shelters. It felt that there is insufficient signage advising the public of free WC facilities nearby. Apart from signage there is little else that could change the habits of the public in this regard given that it is totally impractical to have the buildings monitored 24 hours a day.

The soffits of the concrete roofs are cement rendered and one area on the northern shelter has spalled, exposing rusted reinforcement, due to water leakage from above.

The roof of the northern shelter is drained via two small drainage outlets through the roof slab which then drain down two galvanised pipes running down the two corners of the building closest to the water. The lower section of the left hand pipe is encased in a large concrete/cement fillet, both pipes pass through the concrete floor, into we presume, a stormwater drain. A further rusty pipe is visible penetrating the ceiling and which is thought to be a redundant electrical conduit pipe.

The roof of the southern shelter is drained via two openings in the base of the parapet wall which discharges down the face of the sandstone below and into the harbour.

Externally the render to the base of the parapet wall is cracked along its length and is spalling in isolated areas.

Conclusion

1. Remove the razor wire from the roofs of the northern shelter.
2. Remove the steel bar from the top of the parapet walls of the northern shelter.
3. Remove all rubbish from the roofs.
4. Poison the fig tree on the roof of the northern shelter and once dead then remove.
5. Remove all plants from the roofs.
6. Make good to all areas of defective cement render to the parapet walls.
7. Provide an angled cement fillet at the base of the parapet walls to ensure water does not lay on the over-sailing part of the concrete roof.
8. Form raised plinths on the roof of the northern shelter as mounts for the spotlights.
10. Remove all electrical switchgear from the face of the parapet wall and set aside for remounting.
11. Carefully form two roof drainage outlets 75x75mm in the base of the parapet wall facing the harbour. Line the outlet with code 5 lead including a spout to discharge the rainwater clear of the sandstone under.
12. Provide a cement or similar approved topping to the roofs falling towards the drainage outlets.
13. Line the roof surface and the internal faces of the parapet walls including the top faces with a suitable elastomeric single ply membrane.
14. Remount all lights on their new plinths using stainless steel fixings.
15. Remount all electrical switchgear onto face of parapet wall using stainless steel fixings.
16. The area of spalled concrete to the soffit of the northern shelter should be hacked back to sound material and also to a point where the steel reinforcement is in an acceptable condition.
17. Treat the steel reinforcement with a rust convertor and make good with an approved epoxy repair system.
18. Remove the galvanised roof drainage pipes from the roof together with the rusted conduit pipe and make good the resultant holes.
19. Sandstone should be repointed where necessary with a lime based mortar.
20. Remove all redundant extraneous metal from the face of the sandstone and make good.
21. The areas that have been subjected to salt attack due to the aforementioned urine should be poulticed to help remove the salt.
22. Stainless steel plates should be fitted diagonally across each internal corner and approximately 1200mm high to protect the sandstone from the urine, as it would be almost impossible to stop this practice.

Should you require any further information, please do not hesitate to contact the undersigned.

Yours sincerely,

Malcolm Rolls
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Fax:+61 2 9904 5642
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Condition Assessment Report

Queen Victoria Diamond Jubilee Fountain
Civic Centre Park, North Sydney

December 2014

Water Features Australia Pty Ltd
PO Box 3100, North Turramurra NSW 2074
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1. Overview

Water Features Australia has been engaged by Sydney Artefacts Conservation to provide a condition report on the current hydraulic water feature equipment and provide a recommendation and budget cost for repairs and upgrades.

This condition report provides information on the following items:

- Pumping and Filtration systems
- Chemical dosing and water sanitisation system
- Water level management and system protection
- Plant room access/pipe work layout/equipment
- Plant room electrical controls.

A condition assessment rating is incorporated in the Appendix on page 20.

2. Background

The Queen Victoria Diamond Jubilee Fountain is a circular-shaped feature that incorporates four separate bays. Three crescent-shaped bays surround a lower circular bay with a centre feature display comprising two lower bowls under the upper ball shaped display points. A total of 16 copper jet nozzles supply the display water from the pumping system, with a disturbance line in the centre crescent-shaped bay used to flood the two bays either side. Valved supplies in the plant room are used to regulate the flow rate to the feature system. Weir edges allow the water to cascade into the lowest centre bay. Suction points in the floor of the lower bay supply water to the pumping system used for the display jets. Located within the Confined Space plant room, a filter pump delivers water to the sand filter with the discharged water delivered to a feature booster pump for display supply, however there is currently no incorporated water treatment or sanitation system. The feature has an incorporated water level management system with high level overflow point and a power supply within galvanised control housing.
3. Pumping & Filtration Systems

1. Filtration pump and feature booster pump are operational but visually appear in very poor condition due to their age and from operating in a very damp environment. Replacement of pumps is recommended in a feature refurbishment.
2. The filtration system also appears to be in very poor condition. The age of the filtration media which requires periodic replacement is of unknown age. Replacement of the filtration system would be required in a refurbishment of the feature system.
3. The plumbing in the plant room associated with the feature system is poorly configured. None of the pipe work is appropriately bracketed or supported. Poor plant room configuration also means access for Confined Space entrants to undertake maintenance or repair work is very difficult and dangerous.
4. There is currently no evidence of leaks or issues however old pipe work in the plant room is poorly configured and unsupported. It is recommendation that the entire plant room be rebuilt and expanded. All equipment and pipe work should be refitted and reconfigured for more efficient operation and safer access for Confined Space entrants.
5. The pipe work supplying water to the feature system is currently operational to the extent that it supplies water as intended. Visually, these pipes appear to be in poor condition due to their age and the conditions they operate under. The condition of this pipe work between the plant room and its supply points in the feature are unknown due to their age and the operating conditions.

6. The water tightness of the upper bowls is unknown and the possibility of water-proofing these should be investigated by a water-proofing expert.
4. Chemical Dosing & Water Sanitation Systems

There is currently no chemical dosing or water treatment equipment associated with the water feature system. The existing maintenance protocol of periodically manually dosing the system with liquid chlorine can leave the system vulnerable to a cycle of being under-dosed and overdosed. This method can be equally dangerous in either situation. An under-dosed system can allow bacteria to grow, while an overdosed system can also be dangerous to the public. High concentrations of chemicals from overdosing can be extremely damaging to feature equipment, sculptures and structure.

There are no legislative standards for the chemical dosing of water features however it will be Council’s responsibility to ensure the water sanitisation is kept at a safe level for the public.
5. Water Level Management & System Protection

Water level for the feature system is maintained through a small balance tank located on the outer edge of the lower bowl. While this tank is adequately performing its purpose, the equipment maintained within appears to be in poor condition. The protection screen is deteriorating. In the interests of water conservation, the installation of a water meter on the mains water supply is recommended.
General - Feature

1. All jet nozzles are currently supplying water as intended. The four gravity-fed nozzles in the lower bowl are vulnerable to blockages.
2. It is recommended that improved circulation be achieved by creating greater distribution from the filtration return point. The weir edges from the upper most pool currently supply through a cascading movement around the outer pools and into the lowest pools.
3. Currently, each of the pools has an operating water depth of between 370mm and 450mm. NSW legislation requires that bodies of water of over 300mm water depth be secured by fencing. The reduction of operating depths for each of the bays is recommended. This could be achieved by raising the base of the ponds with concrete.
4. Safety suction screens located in the floor of the lower pool are designed to prevent larger debris from being sucked into the pump. These screens, however, have a very small surface area making them extremely vulnerable to blockages from leaves and litter. Installation of screens with a larger surface area is recommended.
6. General – Plant Room

1. The existing plant room is a confined space and should only be accessed by confined space-trained persons with the appropriate confined space equipment. The access pit lids are a difficult two-man lift to gain access.

2. The existing plant room is undersized to accommodate the required equipment and allow safe access for entrants completing maintenance and repair works. The construction of an entire new plant room of larger dimension is recommended. The access is extremely narrow and there is no access ladder for safe entry and exit.
3. The current plant room has limited standing space due to badly co-ordinated pipe work layout with electrical/extension leads laying on the plant room floor in dampness.

4. Installation of fan-forced ventilation is required to protect the equipment within the plant room and remove moisture.
7. Electrical Controls

1. The existing electrical controls and associated panel within the plant room are in very poor condition and very unsafe. The galvanised panel is showing signs of corrosion and the front panel is missing. Poor quality extension leads with exposed cores are being used for power supply.
2. The time clocks within the panel are not operational and plug-in timers are currently in use. There are also no Residual Current Device (RCD) protections on the system, therefore if an individual comes in contact with a faulty or damp plug, cable or power point there is the risk of electrical shock.
8. Recommendations

The Queen Victoria Fountain hydraulics is generally in poor condition, with many system components having been in operation for extended periods of time.

Our recommendation would be to redesign and resize a plant room that will accommodate the necessary equipment required to make this feature maintenance-friendly and enable safe access for council employees and/or contractors. The plant room should be double the size of the existing plant room and extend out into the grass area. Exact measurements and dimensions would need to be investigated during the design phase.

A redesign of this system should take into consideration the following:

- Large capacity filtration that minimises service visits or plant room access visits.
- Energy-efficient pumps with adequate turnover rates for pond water volume.
- Electrical control panel that incorporates adjustable timers, pump protection, wind sensor and electrical safety.
- The redesign of debris screens and lint strainers.
- Jet nozzle flow rate adjustments.
- Automatic chemical dosing and sanitisation suitable for existing sculpture pipe work.
- A plant room that is safely accessible by employees/contractors.
- Plant room access lids and weight of lids.
- Plant room mechanical ventilation.
- Plant room eye wash.
- Plant room access ladder with extendable handles.
- Reducing the operating depths for each of the bays by raising the base of the ponds with concrete.

9. Budget Cost based on Recommendations

An estimated cost to redesign and reinstall the water feature plant room equipment connected to the existing pipe work that is under the original pond concrete floor would be approximately $30,000-$35,000. This would not include the construction of the plant room, access pit lids or concrete flooring.
APPENDIX: CONDITION ASSESSMENT RATING SUMMARY

<table>
<thead>
<tr>
<th>Condition Rating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<tr>
<td>2</td>
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<tr>
<td>3</td>
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<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>UN</td>
</tr>
<tr>
<td>N/A</td>
</tr>
</tbody>
</table>

Feature Operation, Pumping and Filtration System

Feature Booster Pump Make and Model: Hurlcon CX 240 pump. 240v 750w with built in lint strainer
Filter Pump Make and Model: Astral CTX 280 Pool Pump. 240v 1070w with built in lint strainer
Filtration Type and Model: Hurlcon RX 280 Sand filter

<table>
<thead>
<tr>
<th>System Components</th>
<th>Rating</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hurlcon CX 240 Feature Booster Pump</td>
<td>4</td>
<td>Operational but visually in poor condition. Date of Manufacture - October 2005</td>
</tr>
<tr>
<td>2. Astral CTX 280 Feature/ Filter pump</td>
<td>4</td>
<td>Operational but visually in poor condition.</td>
</tr>
<tr>
<td>3. Hurlcon RX 280 sand filter with multiport</td>
<td>4</td>
<td>Operational but visually in poor condition.</td>
</tr>
<tr>
<td>4. Filter Media</td>
<td>UN</td>
<td>Age and condition of filtration media is unknown.</td>
</tr>
<tr>
<td>5. Plant room pipe work</td>
<td>5</td>
<td>No identified leaks or issues. No bracketing on any pipe work. Poor plumbing layout.</td>
</tr>
<tr>
<td>6. Plant room valves, unions and associated components</td>
<td>4</td>
<td>No identified leaks or issues. Integrity of valves expected to be deteriorating due to age.</td>
</tr>
<tr>
<td>7. Underground pipe work - PVC and copper</td>
<td>UN</td>
<td>All lines are delivering water as required, however condition is unknown.</td>
</tr>
</tbody>
</table>

Chemical Dosing & Water Sanitation Systems

Dosing System Description: Currently no chemical dosing system installed

<table>
<thead>
<tr>
<th>System Components</th>
<th>Rating</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chemical dosing system controller</td>
<td>N/A</td>
<td>No chemical dosing system controller exists</td>
</tr>
<tr>
<td>2. Dosing system lines and associated fittings</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>3. Chemical storage container and spill bunding</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
### Water Level Management & System Protection

**Level System Description:** Small balance tank on side of lowest pool housing make up water ball float form mains water supply and gravity high level overflow to waste.

<table>
<thead>
<tr>
<th>System Components</th>
<th>Rating</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Make up water ball float supplying mains water.</td>
<td>3</td>
<td>Operating effectively but component age is visually evident.</td>
</tr>
<tr>
<td>2. Water meter for water consumption monitoring</td>
<td>N/A</td>
<td>Currently no water meter on the system.</td>
</tr>
<tr>
<td>3. Low level cut out / flow switch protection.</td>
<td>N/A</td>
<td>No low level cut out or flow switch protection exists on the feature system.</td>
</tr>
<tr>
<td>4. Level tank protection screening</td>
<td>4</td>
<td>Protection screening and cage in OK condition but wall mounting points deteriorating.</td>
</tr>
<tr>
<td>5. High level overflow</td>
<td>2</td>
<td>High level overflow operating fine with no evidence of blockages.</td>
</tr>
</tbody>
</table>

### General - Feature

<table>
<thead>
<tr>
<th>System Components</th>
<th>Rating</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Water delivery - Jet nozzles, weir spouts and disturbance points</td>
<td>3</td>
<td>Full condition of copper lines supplying jets unknown.</td>
</tr>
<tr>
<td>2. Sandstone coping stones and surrounds</td>
<td>3</td>
<td>Generally ok. Showing visual signs of wear from their age.</td>
</tr>
<tr>
<td>3. Feature interior - water proof paint</td>
<td>4</td>
<td>Visually deteriorating but unknown if any leaks exist.</td>
</tr>
<tr>
<td>4. Centre sculpture and bowls</td>
<td>5</td>
<td>Restoration works to be completed.</td>
</tr>
<tr>
<td>5. Debris suction screening</td>
<td>4</td>
<td>In quite good condition but very small surface area make them very vulnerable to blockage.</td>
</tr>
</tbody>
</table>

### General - Plant Room

<table>
<thead>
<tr>
<th>System Components</th>
<th>Rating</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Plant room entry/ pit lids</td>
<td>5</td>
<td>Heavy lids are a difficult two man lift. Very narrow lid creates limited access.</td>
</tr>
<tr>
<td>2. Plant room access and ladder</td>
<td>N/A</td>
<td>No plant room ladder is present. Access is very difficult and unsafe.</td>
</tr>
<tr>
<td>3. Plant room lighting</td>
<td>N/A</td>
<td>No lighting.</td>
</tr>
<tr>
<td>4. Plant room ventilation</td>
<td>N/A</td>
<td>No fan-forced ventilation is present.</td>
</tr>
<tr>
<td>5. Plant room drainage</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
### Electrical Controls

<table>
<thead>
<tr>
<th>System Components</th>
<th>Rating</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Control Panel housing</td>
<td>5</td>
<td>Galvanised housing in poor condition. Lid has been removed from housing.</td>
</tr>
<tr>
<td>2. Electrical controls and protections</td>
<td>N/A</td>
<td>Installed time clocks are not operational. Plug in timers in use.</td>
</tr>
<tr>
<td>3. Feature lighting</td>
<td>N/A</td>
<td>There is currently no feature lighting installed.</td>
</tr>
</tbody>
</table>