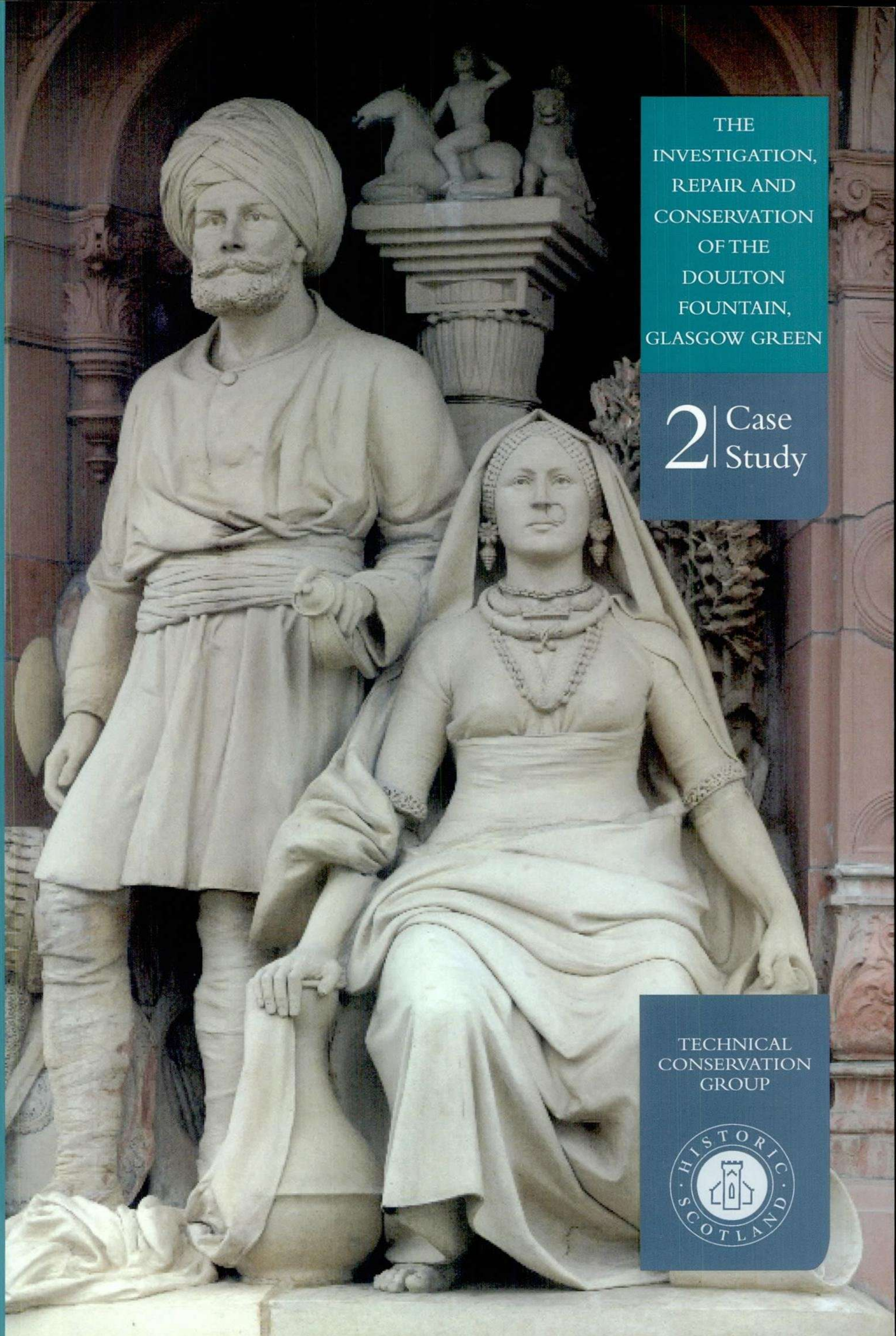

THE INVESTIGATION, REPAIR AND CONSERVATION OF THE DOULTON FOUNTAIN, GLASGOW GREEN

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The Investigation, Repair and Conservation of the Doulton Fountain, Glasgow Green

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THE INVESTIGATION, REPAIR AND CONSERVATION OF THE DOULTON FOUNTAIN, GLASGOW GREEN

by Nicola Ashurst

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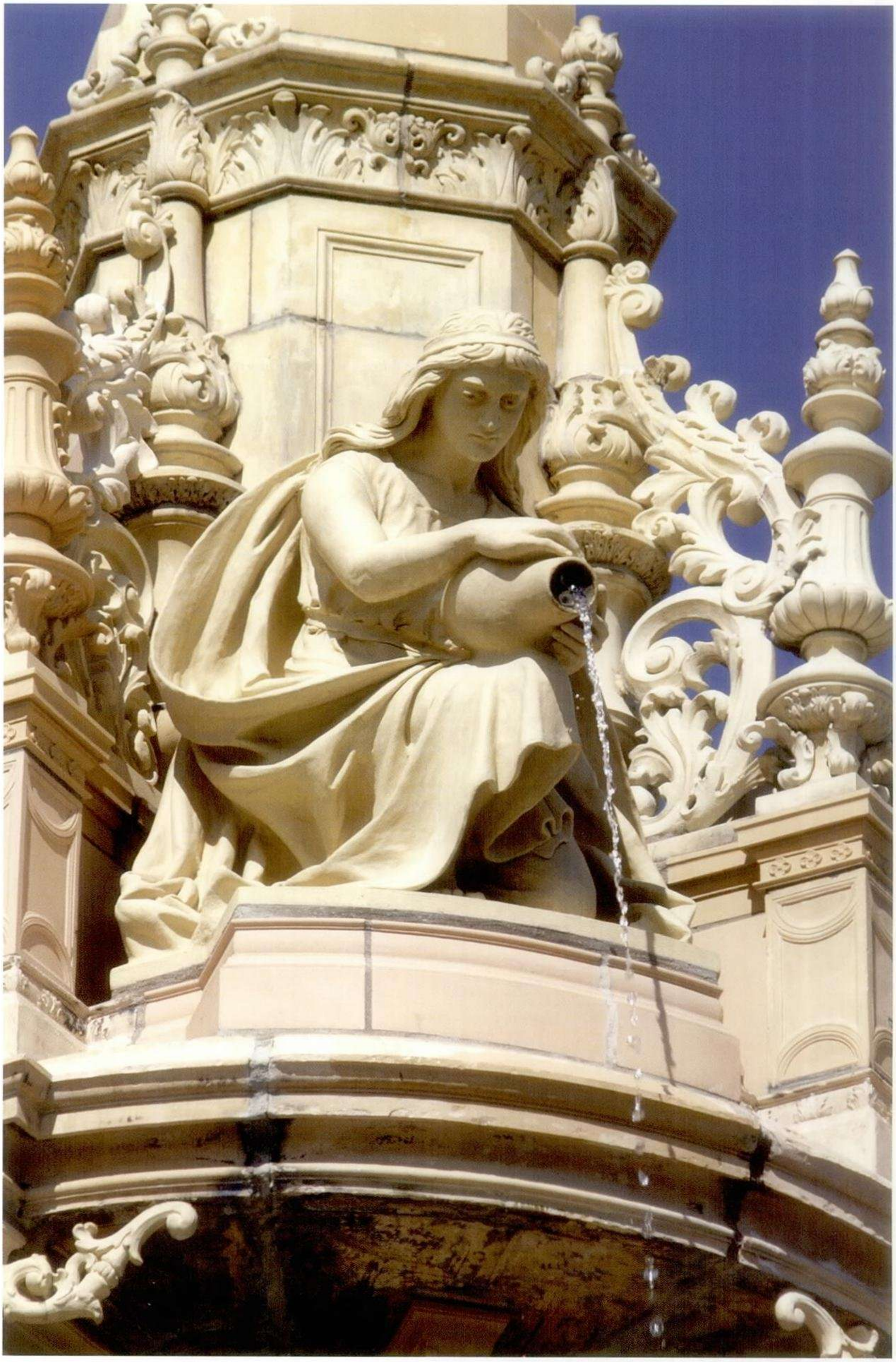
The Doulton Fountain, restored and operational, in its new location on Glasgow Green. *(Neil Baxter & Associates)*



A new Water Bearer surrounded by repaired terracotta. *(Neil Baxter & Associates)*

FOREWORD

The Glasgow International Exhibition of 1888 was a spectacular event, a showcase of industry and technology in particular.

Two fountains were on the site – one a cast iron creation by the Glasgow firm of McDowall Steven & Co, and the other the Doulton Fountain. Following the conclusion of the Exhibition, the iron fountain was moved to Cathedral Square, the Doulton Fountain to Glasgow Green.

The iron fountain was lost, and the Doulton fountain was in very poor condition. Vandalism and natural decay had caused significant deterioration to the fabric of the fountain.

The conservation and restoration work involved was complex and required a broad range of partners to be brought together. The result is a spectacular achievement of which all of those involved can be rightly proud.

This volume documents the project itself, but should also be of interest to those dealing with architectural terracotta. These materials are more common in our built environment than is often appreciated. It is entirely appropriate for us to document this wonderful project, both to create a record for future generations, and to record the skills and expertise of those involved.

David Mitchell
Director
Technical Conservation Group
Historic Scotland
November 2008

New lighting highlights the details of the ornate terracotta and the water jets, providing a spectacular display. *(Neil Baxter & Associates)*

SUMMARY

The Doulton Fountain was manufactured in 1888 out of terracotta. The 13m high, elaborately designed fountain, formed part of the Glasgow Exhibition of that year. It was gifted to the City of Glasgow by Sir Henry Doulton and moved to the West End of Glasgow Green in 1890 at his expense. A spectacular piece of Victorian design, the Doulton Fountain enthralled its visitors for many decades.

From the 1970's on it began to show signs of deterioration due to weathering and vandalism.

The Doulton Fountain received listed status Category A on 15 December 1970. In the mid 1990's it began to receive attention as part of a regeneration scheme for Glasgow Green. In 2005 after a meticulously planned conservation and repair programme, the Doulton Fountain was switched on again in its new location, outside the principal frontage of The People's Palace, Glasgow Green.

The project was managed by Glasgow City Council (GCC), owners of the Doulton Fountain. The Council's commitment to the project was key to its commencement, continuity and completion.

This report starts with discussion of the history of the fountain and its relationship to Glasgow Green. It describes the material of which the fountain's components were made, fired clay, its characteristics and the reasons for the fountain's deterioration. The report describes considerations that needed to be incorporated in the set-up of the project. The project required a tailored and individual approach to its contract and the relationships that needed to be in place between the client, consultants, manufacturers, the conservator and the main contractor were bespoke.

The report then goes on to describe the extensive period of research and recording that was undertaken before any works began. It describes the specialist studies that were undertaken into the nature and condition of the fountain's blocks and its sculptures. The construction phase is also described in detail beginning with the labelling and recording of the blocks, the block by block assessments and the conservation strategy that was developed for the sculptures.

Next the report follows the downtaking period and the decision making process that was necessary for deciding the final, appropriate works to each block and each piece of each sculpture. The repair and conservation techniques that were undertaken are described in detail as is the process of manufacturing of new terracotta blocks and pieces of statuary. Finally the process of rebuilding the fountain is described.

The restoration of the Doulton Fountain was unique not only because it is the largest terracotta fountain in the world, but also because of the very detailed considerations that were necessary at every stage of the project. The uniqueness of the Doulton Fountain meant that an overriding parameter was that as much original material that could be retained should be retained.

The restoration of the Doulton Fountain was grant aided by several parties including Historic Scotland. This report has been prepared to fulfil one of the grant requirements, that the project should be documented in a detailed technical document.

The Doulton Fountain at the Glasgow Exhibition of 1888, in Kelvingrove Park. *(Special Collection University of Glasgow)*

1 HISTORY AND DESCRIPTION OF THE DOULTON FOUNTAIN

1.1 The Glasgow Exhibition of 1888

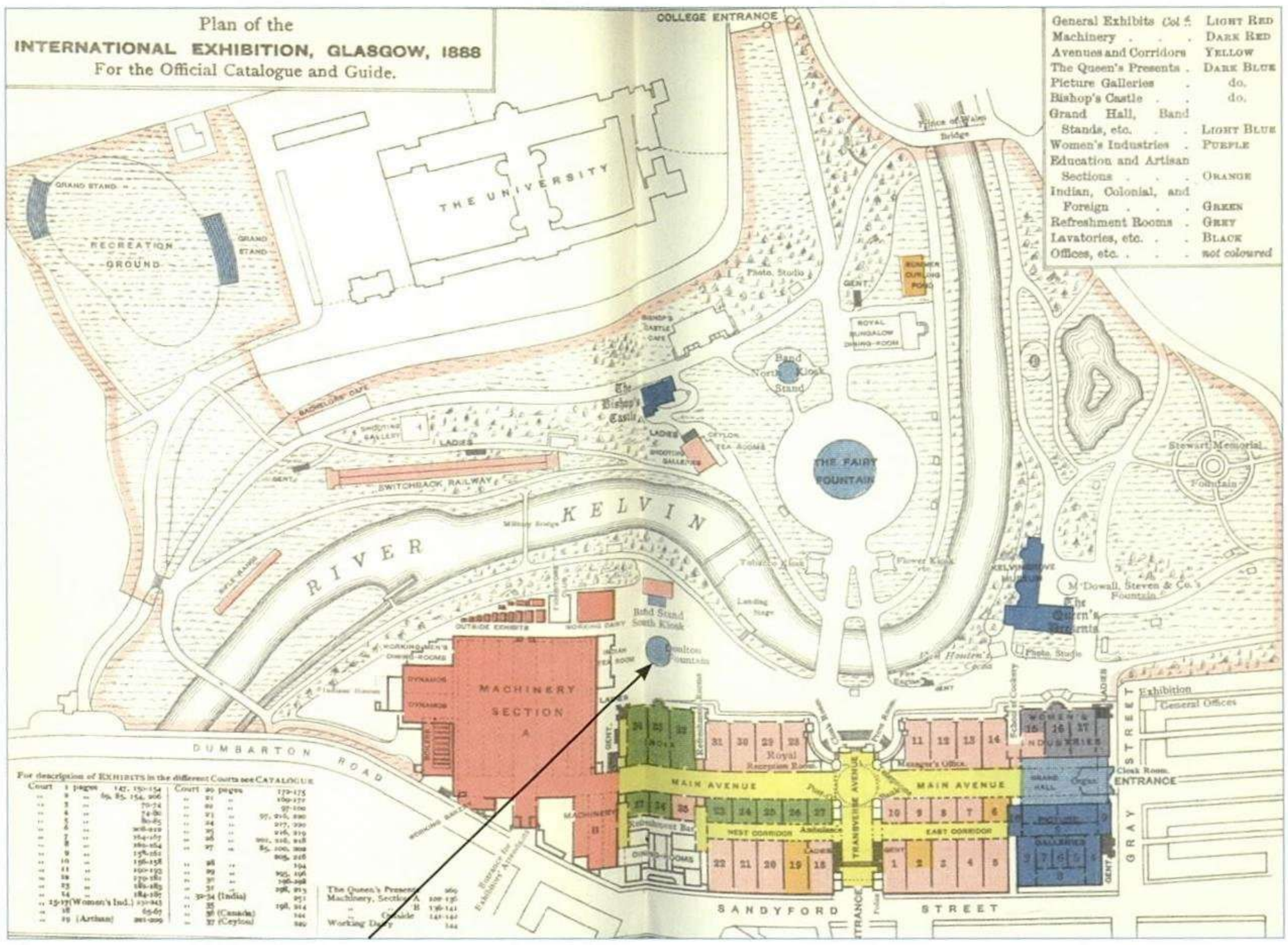
The Doulton Fountain was manufactured in terracotta in 1888 by Doulton & Co. It had an overall height of 13m, an outer basin diameter of 21m and 13 individual figures and groups of figures which were just under life size.

The fountain is a monumental piece of sculptural work produced to commemorate Queen Victoria and the British Empire of which she was head.

The fountain was first displayed at the Glasgow International Exhibition of Industry and Science (The Great Exhibition) of 1888. The exhibition took place in Kelvingrove Park from the 3 May until the 10 November 1888. The Doulton Fountain was intended as a personal gift to the City of Glasgow by Sir Henry Doulton, not as part of the company's commercial display, although it did become a principal attraction.

> *'Henry Doulton well understood the potential of national and international exhibitions as a means of promoting the Doulton name, and so he made it the policy for the company to display their products as widely as possible during the latter part of the 19th century. In the process Doulton achieved a world-wide reputation, and gained an outstanding number of medals and awards'. (Atterbury & Irvine, 1979, 11).*

The Doulton commercial display at the Glasgow Exhibition included a number of interior stands of structural stoneware, decorative art pottery and sanitary appliances as well as a second fountain, under the dome of the main exhibition hall. Doulton & Co. also provided sanitary ware for the toilets and retiring rooms and much of the decorative tile work throughout the exhibition buildings.



At the Glasgow Exhibition, the Doulton Fountain was located between the main exhibition buildings and the River Kelvin. *(Glasgow Museums Service)*

'The Doulton Fountain may well have been inspired by the fact that in 1887 Henry Doulton had been knighted, it also commemorated the fact that in 1888 Queen Victoria was made Empress of India. This was further celebrated by the fact that Doulton also had an Indian Pavilion which formed part of the internal exhibition.'

(Official Catalogue of the Glasgow Exhibition, 1888, as quoted in McKenzie & Nisbett, 2002, 169)

Although not an official exhibit at the Great Exhibition, the Doulton Fountain was enormously popular. Many aspects of it were debated publicly including the suitability of terracotta for such a large scale public work. According to the British Architect (1888,199).

' ... the work finely illustrates the freedom afforded by the material to a capable modeller, and it is also well to bear in mind that when burnt the substance is considered practically imperishable and impervious to atmospheric influences'.

Many were impressed that the time from when the decision was taken to make the fountain to when it was erected, was eight months.

1.2 Description of the Fountain

'The fountain is a three-storey structure designed in a florid style derived from the French Renaissance architecture. Broadly conical in its overall shape, it has a standing portrait of Queen Victoria at the apex and the complex figurative programme celebrating the British Empire below. An internal hydraulic system..., originally pumped water through the central column to a group of four kneeling maidens holding inverted pitchers on the upper level. From here the water flowed into a cantilevered circular basin on the first storey, subsequently spouting through the mouths of the lion heads and grotesque masks into the large ground basin on which the main structure is raised. Designed on a quatrefoil plan, the ground basin has reliefs of the Glasgow arms, including miniature half-length images of St Mungo... in the centre of the four convex sections. Surrounding the main structure is a large circular pool enclosed by an outer retaining wall divided by 24 pedestals which were originally capped with urns'. (McKenzie & Nisbet, 2002, 167-168)

Water for the fountain came from the Glasgow mains supply. It originally operated from 6pm to dusk daily from 1st May to 1st September and Saturday and Sunday afternoons during the months of March, April, September and October.

1.3 Doulton & Co. and the Lambeth School of Art

1.3.1 Doulton & Co.

Doulton & Co. was founded in 1815. It is the company now known as Royal Doulton, famous for its fine pottery and tableware.

After the death of his father in 1854 Henry Doulton was left in charge. Doulton & Co's involvement in the production of terracotta for the building construction industry was strongly encouraged by him. By the late 1800's Victorian architects had been assured of the durability of terracotta by seeing the construction of several prominent London buildings such as Dulwich College and the Victoria and Albert Museum.

1.3.2 Lambeth School of Art

The Lambeth School of Art was established in 1854. Henry Doulton became a mentor to the school. It was Art Master John Sparkes who first suggested the idea that the school and Doulton's pottery company collaborate in making art pottery. Doulton & Co. took many of its pottery painters and modellers from there.

1.4 The Designer and the Modellers

Doulton Fountain was designed by Arthur Edward Pearce.

The sculptures were modelled by John Broad, Herbert Ellis, Arthur Edward Pearce, Frederick Pomeroy (as set out in the table below) and possibly other students and graduates of the City and Guilds of London Institute Technical Arts School, Kensington, and Lambeth School of Art. The modelling supervisor was William Silver Frith.

Sculpture	Modeller
Victoria: Original Figure	W.S. Frith
Victoria: Replacement Figure	J Broad
Water Bearers	Not known although there are two distinct styles of modelling
Military Figures	F W Pomeroy
India	J Broad
Canada	W S Frith
South Africa	H Ellis
Australia	F W Pomeroy

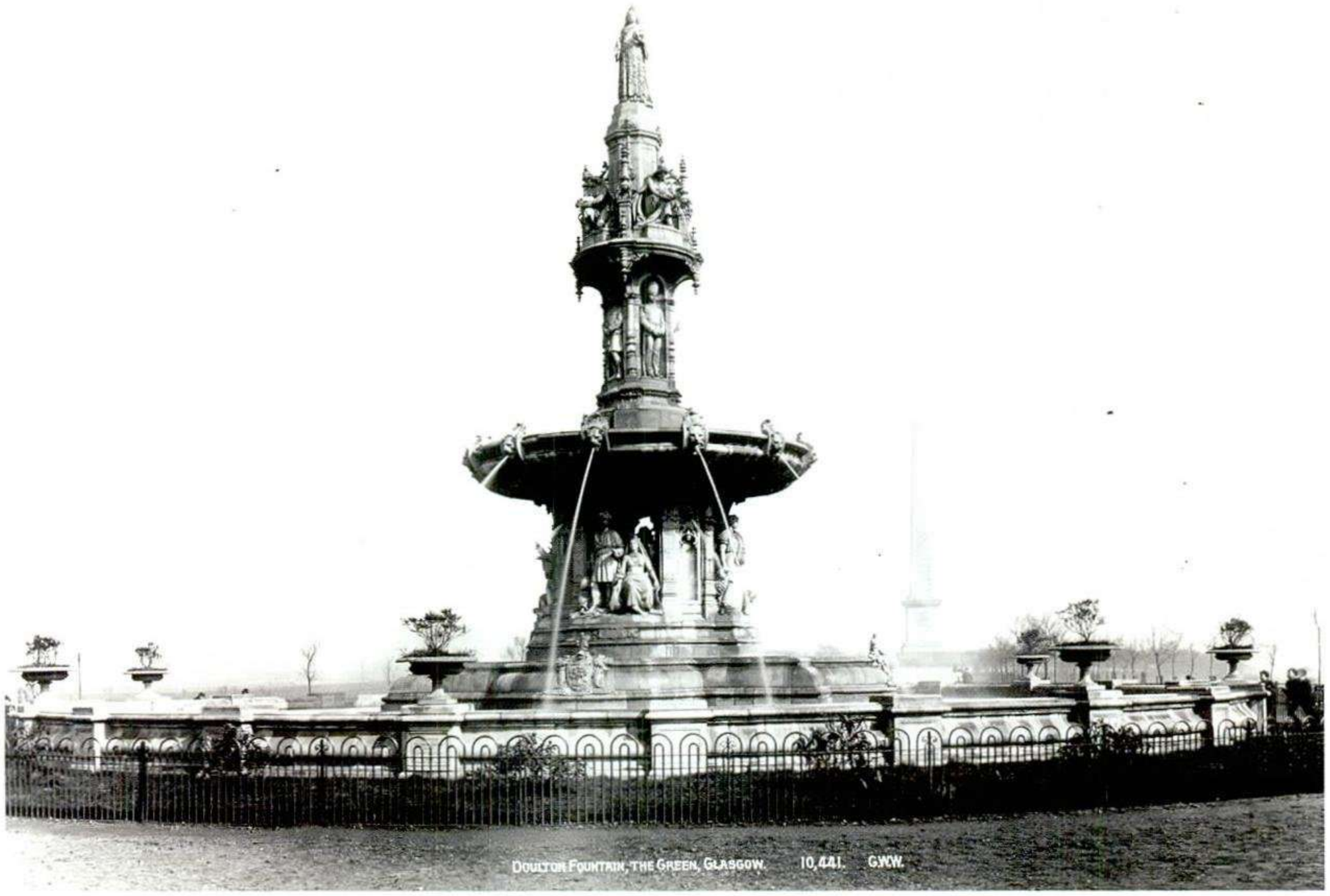
Arthur Edward Pearce, principal designer of the Doulton Fountain had studied architectural design, worked as an illustrator and taught drawing before he joined Doulton in 1873. He remained with the firm until 1930 and during this time he designed several fountains. His design of the Doulton Fountain, his best known, was conceived with the help of W S Frith. At the Glasgow

Exhibition Pearce also designed the glazed terracotta of the Indian pavilion. Arthur Pearce modelled the original figure of Victoria.

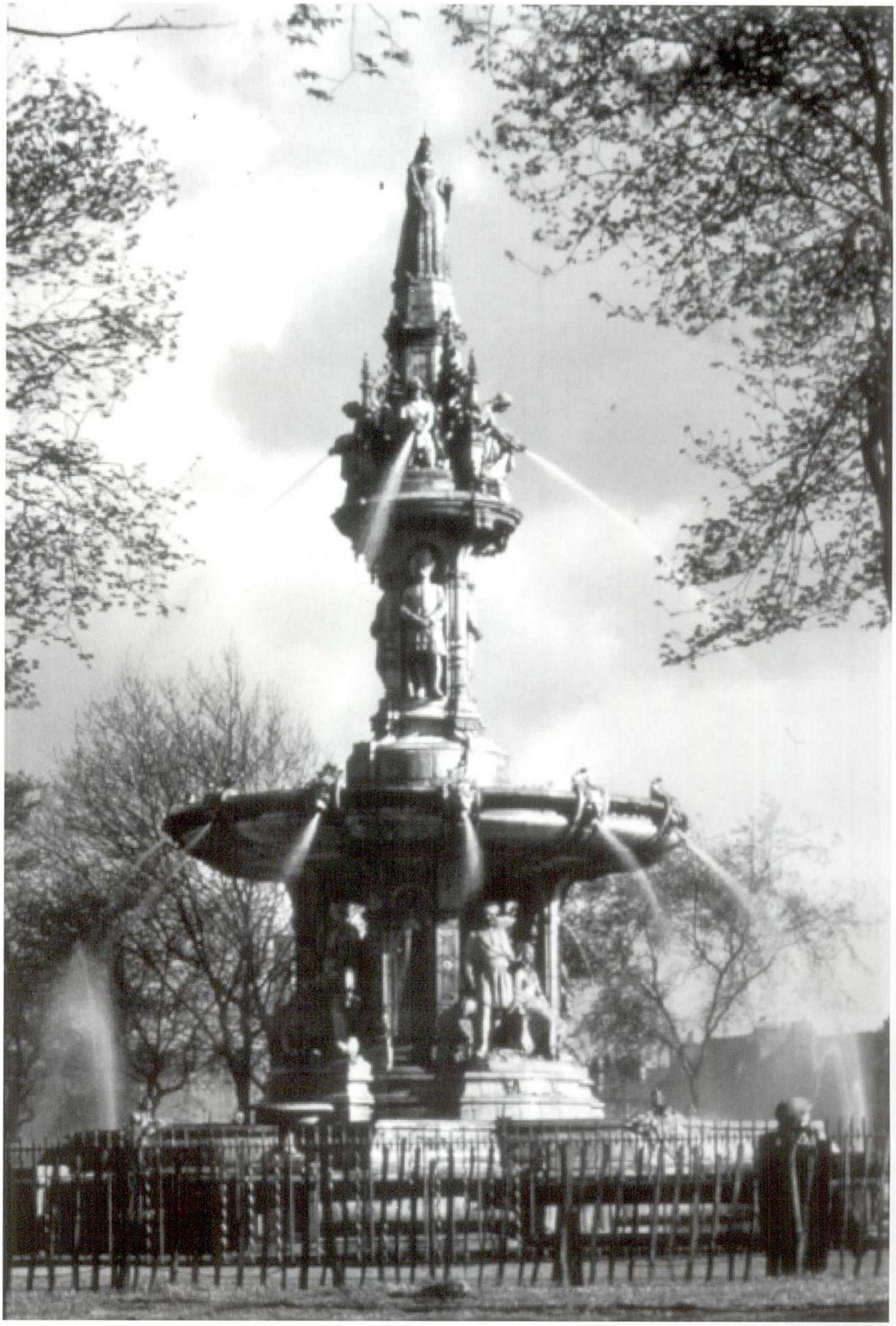
John Broad worked at Doulton's from 1873-1919. Herbert Ellis worked at Doulton's from 1877-1928.

Supervision of the modelling of all the sculptures was undertaken by William Silver Frith (1850 – 1924). At the Lambeth School of Art Frith taught many of the sculptors and students who went on to join Doulton & Co. One of these was Frederick W Pomeroy, the modeller of the Australia group.

The Doulton & Co. signature on the base of the Canada group. *(Hathernware)*



The fountain soon after erection at the West end of Glasgow Green. Nelson's Monument also listed Grade A, can be seen in the background. *(George Washington Wilson)*



The fountain in operation. *(People's Palace Museum)*

1.5 Description of the Sculptures

1.5.1 Queen Victoria

At the top of the overall conical shape of the Doulton Fountain stands a portrait of Queen Victoria, dressed as the Empress of India. The lace of the dress is superbly and intricately detailed. She is made of five pieces: her body is joined at the shoulders and her hands and sceptre are made separately. Her Majesty stands on a three-stage octagonal base, surveying her empire, bearing the orb and sceptre and wearing the imperial crown.

Queen Victoria, as Empress of India is situated at the top of the Doulton Fountain (Printed with the permission of Mayfair Cards of London)

The original figure of Victoria was modelled by W S Frith. The current figure, the replacement installed after the lightning strike of 1894, was modelled by John Broad.

1.5.2 The Four Water Bearers

The next level of the fountain comprises a central octagonal shaft, divided into four by ornate buttresses. Between these are four kneeling maidens in diaphanous dresses, each with an inverted vase resting on her raised right knee. These sculptures have several variations in the positions of the hands and the treatment of their hair and draperies.

The name of the modeller of the four Water Bearers is not known and the sculptures are not signed. Their style suggests they are based on the same female and that two modellers produced the figures.

Four Water Bearers are positioned on the tier below Victoria *(Nicola Ashurst)*

1.5.3 The Four Servicemen

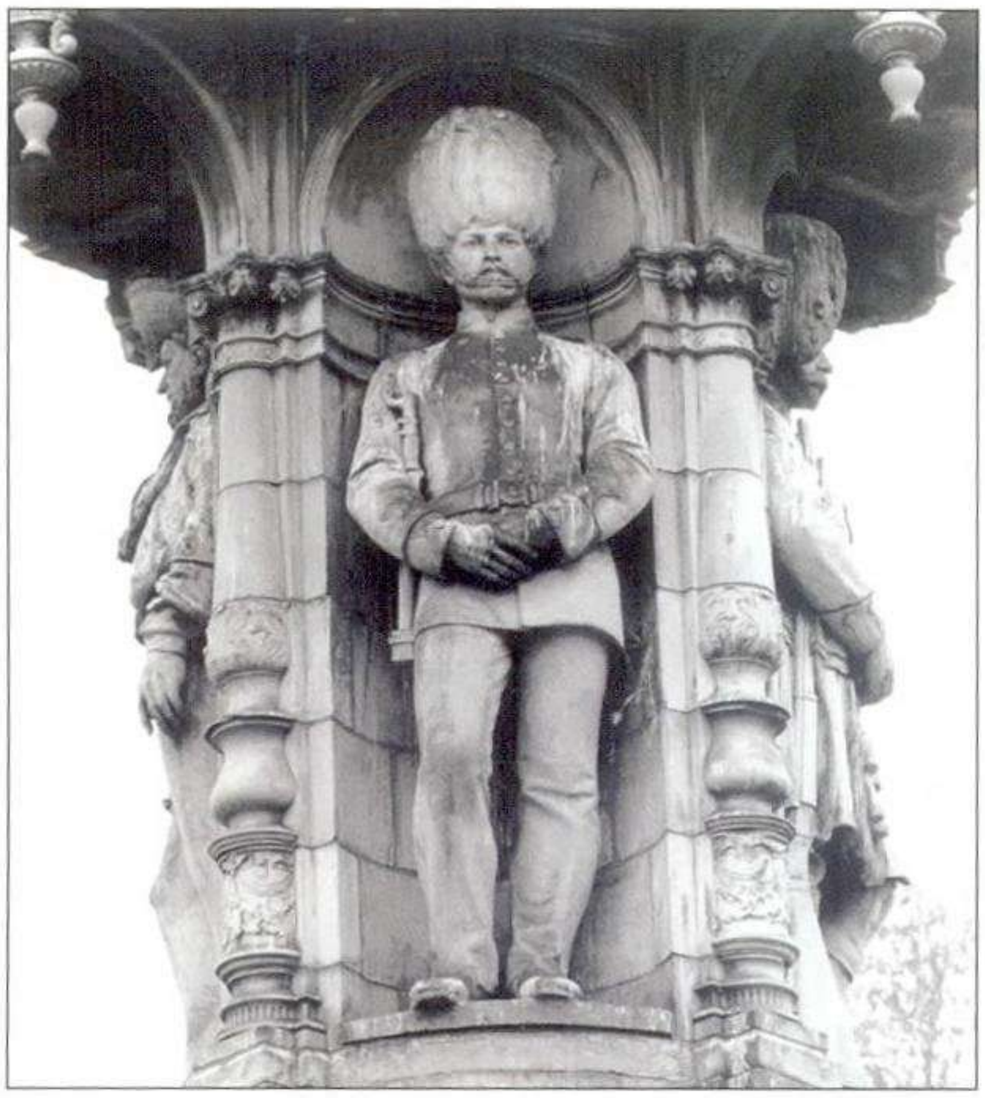
The four servicemen figures stand as sentries within recessed arches to the central shaft and include:

- A sailor, belonging to the Royal Navy
- Three soldiers representing:
  - The Grenadier Guards
  - The Black Watch Highlanders
  - The Royal Irish Fusiliers

The modeller of the four servicemen was F.W. Pomeray. The four figures have superb attention to detail ranging from bayonets to guns through to raised lettering on uniform buttons.

Sailor

Black Watch Highlander



Royal Irish Fusilier

Grenadier Guard

(All: Cortauld Institute)

1.5.4 The Four Colonial Groups and City Arms

Four groups of figures are located within arched openings beneath the cantilevered basin. They represent the four continents that the British Empire stretched to.

> *Each one is composed of a male and female figure in national costume, and is accompanied by the symbols of the history, industry, and agriculture, of those countries. (British Architect, 1888, 199).*

In most cases the male figure is standing, while the female is seated, Australia being the exception.

i) INDIA

Modelled by: J. Broad Unsigned

'...the Indian Empire is portrayed by a male figure, armed; representative of the military history of the vast country, and at his side is a trophy of native arms of various periods. The female figure has reference to the arts and industries, typical examples of the manufactures being grouped around her; in her hand is a scroll of manuscript, to suggest the wonderful literature of India's many-centuried past; the other hand rests on a piece of pottery and a silken shawl, as specimens of the manual industries. In the background is some growing rice...a column surmounted by a group of figures calls to mind [India's] picturesque architecture'. (British Architect, 1888, 199).

The clay model in the workshop

The terracotta figures in the fountain

Detail of the lady's head

Detail of the gentleman's head *(All: Cortauld Institute)*

ii) CANADA

Modelled by: William Silver Frith.

Unsigned

'Canada is represented by a figure of a trapper, habited in leather costume, and bearing in his hand the head of a moose ox and over his arm skins and furs. At his feet is a beaver. At the side is a female figure warmly clothed in blanket costume and seated on the stump of a felled tree. She bears a shaft of wheat and one hand rests on a felling-axe. At her feet are blocks of coal and a miner's pick, and in the background the rock of sugar-maple is growing'. (British Architect, 1888, 199)

The clay model in the workshop *(Cortauld Institute)*

The terracotta figures in the fountain *(People's Palace Museum)*

Detail of the lady's torso *(People's Palace Museum)*

The figures after vandalism has begun *(Hathernware)*

iii) SOUTH AFRICA

Modeller: Herbert Ellis

Signed: H. Ellis

'To represent the South African Colonies there are figures of a farmer of European race, standing armed over his crops, and a seated figure of a native woman, surrounded by the various products of her country; the spade on which one hand rests refering to the mineral resources, the vine and maize to the agriculture, and the heap of wool and the ostrich in the background to the animal produce'. (British Architect, 1888,199).

The clay model in the workshop *(Cortauld Institute)*

The terracotta figures in the fountain after loss of ladies head

Details of the farmer *(Cortauld Institute)*

(St Mungo's Museum, Glasgow)

iv) AUSTRALIA

Modeller: Frederick Pomeroy

Unsigned.

'Australia is typified by a figure of a gold-digger resting on his spade and a female bearing a sheaf of wheat; her hand rests on a sheep, and a vine grows beside her, these refering to the wool and wine industries, as the fan-palm in the background does to the climate'. (British Architect, 1888, 199)

v) THE ARMS OF THE CITY OF GLASGOW

In front of each Colonial Group, the design included the Arms of the City of Glasgow.

(Nicola Ashurst)

The terracotta figures in the fountain *(Cortauld Institute)*

The group after loss of both torsos *(People's Palace Museum, Glasgow)*

Detail of the lady *(Hathernware)*

Detail of the man *(Hathernware)*

1.6 The construction of the fountain

The base of the fountain was a ground-bearing concrete slab to a central core constructed in brick to form a chamber housing the pipework and valves for the water supply. This brickwork supported eight cast iron columns founded on sandstone blocks built into the brickwork. The inner water basin at the level of the four colonial statues was a concrete slab spanning from the brick core to an outer brick wall clad with the terracotta which included the Glasgow Coats of Arms.

The outer basin wall and the central plinth of the fountain were comprised of a core of Glasgow Brick clad with terracotta blocks. The central brick core supported a concrete filler joist platform. From here the terracotta clad eight cast iron columns which formed the recesses of the colonial groups. From a cast iron ring beam at the top of the columns a series of twelve cast iron "arms" extended, terminating at an outer wrought iron ring beam and forming the structure of the cantilevered basin. The wrought iron ring beam was tied by a cruciform rod arrangement connected to a ring at the centre, below the crown of the terracotta dome. The terracotta spandrel panels of the cantilevered basin were hung off a series of terracotta channels which rested on the cast iron arms, with the outer ring beam being clad by twelve lion's head water spouts and a moulded block edging.

The upper shaft of the fountain was supported by a terracotta dome which started at the base of the cantilevered basin.

Higher up the cantilever supporting the water bearers was supported by a wrought iron cruciform beam arrangement built into the brickwork core.

Finally, Queen Victoria was held in position by a hollow steel tube, similar to scaffolding poles, set into a hard concrete core, not an original fixing detail.

The original water distribution system comprised a six inch cast iron pipe taken directly from the mains water supply, passing directly into a central chamber where a large cast iron four-point distribution point split the supply. The various water outlets to the fountain were fed by a series of lead pipes.

1.7 Erection of the Fountain on Glasgow Green

Glasgow Green is historically and spiritually at the heart of Glasgow. During the last 900 years it has functioned as publicly accessible open space.

1.7.1 The history of Glasgow Green

The history of Glasgow Green is fascinating, eventful and fundamental to the development of Glasgow.

> *'Glasgow Green occupies an area of 136 acres, and stretches for approximately 1½ miles along the north bank of the River Clyde east of the Saltmarket. Its origin can be traced back to 1450, when James II of Scotland granted a tract of land to Bishop William Turnbull, who in turn gifted the land to the community.' (GCC, HLF Document, 1996)*

> *'Glasgow Green, the oldest public park in the United Kingdom, is remarkable in the unique contribution it has made in the lives of the people of Glasgow, Scotland, the United Kingdom, Europe and the World. It is the place where Watt conceived the idea of the steam condenser which brought the Industrial Revolution. It is also the origin of the Trade Union Movement, the European Temperance Movement amongst others. It is firmly associated with the birth of both Celtic and Rangers football clubs and was the site of the first City Golf Course. It is regarded as one of the great social battlefields in Europe through its association with corporal punishment, religious, political, suffrage and other momentous demonstrations... At the height of the Industrial Revolution, it provided a green oasis, a welcome release from appalling, cramped and unhealthy living conditions in the surrounding areas ... There can be few other city parks that are so revered and fiercely protected by its citizens. Glasgow Green is the People's Park; it is their heritage.' (GCC, HLF Document, 1996)*

The physical appearance of Glasgow Green which is seen today originates from a series of improvement works carried out between 1815 and 1826 by the Superintendent of Public Works, James Cleland.

The historic landscape of Glasgow Green contains architecture of historic significance. These items are:

The Doulton Fountain	Grade A
The People's Palace	Grade A
Nelson's Monument	Grade A
McLennan Arch	Grade B
West Boat House	Grade B
Martin Fountain	Grade B
Sir William Collins Memorial Fountain	Grade B

1.7.2 Locating the Fountain on Glasgow Green

The question of where the Doulton Fountain should be located at the end of the Great Exhibition of 1888 continued into 1889. Once Glasgow Green had been selected debate continued as to which part of the Green. Eventually a site close to the west entrance of the Green, with Queen Victoria facing the High Court on the Saltmarket was agreed. (McKenzie & Nisbet, 2002, 169)

Sir Henry Doulton paid for the dismantling and reconstruction of the fountain on its new site. Ballin Smith (1999, 8) reports that the process involved a number of minor modifications to the design, including the rearrangement of the positions of two of the Water Bearers, perhaps due to breakage of blocks during the reconstruction process and misnumbering of the Water Bearers.

> *The inauguration of the rebuilt fountain took place on 27 August 1890, which was designated as a special fountain day in Glasgow. (McKenzie & Nisbet, 2002, 169)*

1.8 Damage & deterioration of the terracotta begins

Once rebuilt at the western end of Glasgow Green, the Doulton Fountain did not remain intact for long.

1.8.1 The Lightning Strike of 1894

In 1894 Queen Victoria was struck by lightning. She was reported to have been totally destroyed although pictorial evidence showed a headless queen. A contemporary photograph also exists showing the fountain with the top statue missing.

Comparison of the existing figure with archival evidence of the original figure show several minor differences between the two. The join in the existing figure at the top of Queen Victoria's dress line, across which details of her dress are discontinuous, does not fully tally with the fact the whole sculpture is reported as having been replaced.

Since all the sculptures on the Doulton Fountain were produced directly by the artists, without the use of moulds, the cost of a replacement of Queen Victoria was going to be similar to the cost of the original figure. The Glasgow City Council Engineer suggested that an urn should replace Queen Victoria on the top of the fountain. Sir Henry Doulton's response to this was to offer to pay for the reinstatement of the figure and the provision of a lightning conductor.

When the lightning conductor was installed the four arched elements at the top Queen Victoria's crown were deliberately damaged so that its terminal could be installed. One of these plus the cross to the top of the crown was missed out.

The fountain on Glasgow Green in 1986. *(Cortauld Institute)*

Damage due to the lightning strike was also sustained by the ornate screens between the Water Bearers and the central shaft. It is possible that the yellow coloured terracotta pieces to this area were replaced at that time. It is also possible that the figures of the Water Bearers were also affected by the strike, in a way that was not immediately identifiable at the time. Close range inspection of the figures in 2000 revealed serious parallel fracturing to various extremities, uncharacteristic of the weathering deterioration being experienced elsewhere on the sculptures.

1.8.2 Maintenance Issues Begin

> *Maintenance difficulties began as early as June 1896, when it became necessary not only to repair a leak which had appeared in one of the basins, but also to erect a higher railing around it to prevent children getting access to the structure. (McKenzie & Nisbett, 2002, 163)*

A few months later the City Engineer reported that the fountain had already sustained malicious damage. *(McKenzie & Nisbett, 2002, 163)*

The condition of the Doulton Fountain was reported on twice in 1953 by the Glasgow Herald. On 18 March the paper reported that an offer by a firm of monumental sculptors to repair the fountain on a cost-basis, for an estimated cost of £650 had been accepted. On the 23 March the fountain was recorded *'... in need of a good scrub, the South African lady wants a hand, St Mungo has four times lost his head'. (Glasgow Herald, 1953, 3).*

The water supply to the fountain had always been an issue due to the amount of water it used, and the reduction of pressures experienced by those parts of Glasgow serviced by the same water main. The working of the fountain became a rare event, reduced to weekends over the summer months. It was also about 1953 that the water supply to the fountain was cut off, providing further encouragement for vandals. *(The Bridgegate Trust Ltd., "The Doulton Fountain, Glasgow Green. A Feasibility Study Prepared for Glasgow Distrct Council", 1990)*

Archive photographs of the Doulton Fountain in 1957, 1959 and 1961 show the Doulton Fountain to be non working and to have most of its terracotta intact.

From 1979 pieces dislodged from the fountain and were collected and stored by the staff of the People's Palace.

By 1979 the condition of the fountain had deteriorated seriously and shoring was installed to the underside of the cantilevered basin. A high chain link fence was installed around the fountain perimeter to prevent public access.

Also at this time a terracotta manufacturer was called upon to look at the feasibility restoring the fountain. In 1984 Hathern Ceramics Limited prepared a photographic survey and a ground level condition report which reported conditions which were no where near as poor as those in evidence 20 years later.

1.8.3 Listing of the Doulton Fountain

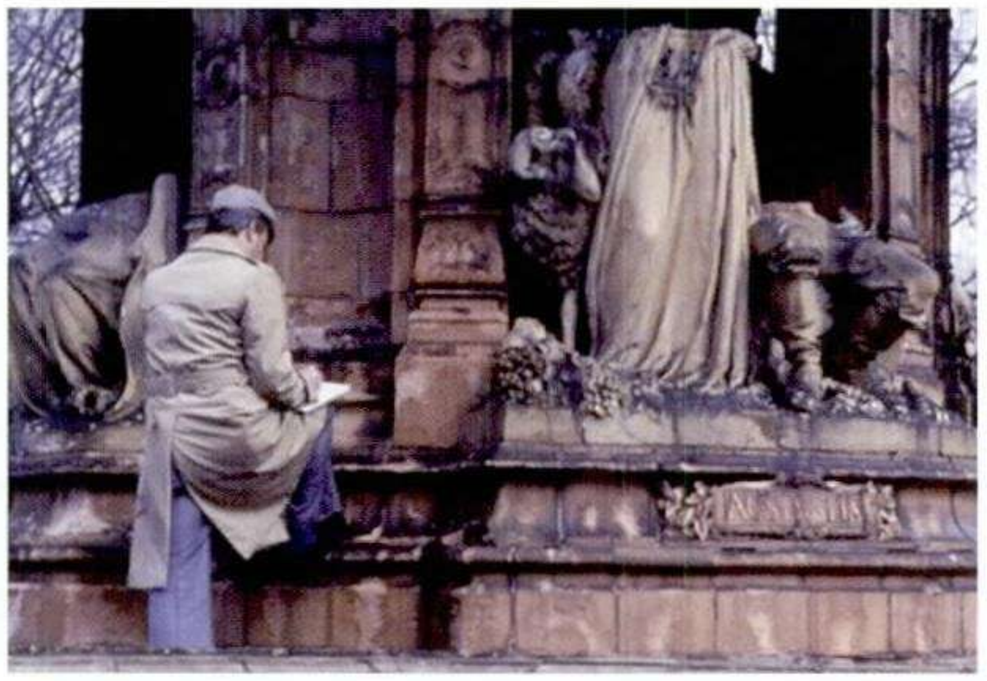
The Doulton Fountain was listed Grade A on 15 December, 1970. This recognition provided the needed impetus for the care of the fountain.

1.8.4 The Bridgegate Trust Report

In 1990 a feasibility study for the repair of the Doulton Fountain was prepared for Glasgow City Council by the Bridgegate Trust, an independent charitable trust dedicated to the regeneration of Glasgow, its heritage and buildings. The remit of its study was to establish the costs, funding requirements and management organisation necessary for the full restoration of the fountain using original materials and at its present location.

The report found that much of the terracotta was damaged or missing with approximately 40% being assessed as reusable. It also recommended that the fountain be dismantled and a new steel structure installed.

The Bridgegate Trust Report established the perilous condition of the Doulton Fountain and quantified the scale of the work that would be required to put things right. It was an important first step in its care and return to life.



The staff of Hathenware Ceramics Limited survey the fountain in 1984.

Even when it was not operational, the Doulton Fountain was a big draw for the families of Glasgow. *(Private Collection)*

2 THE NEED FOR RESTORATION

The full process of the restoration of the Doulton Fountain, from initiation of the concept report to the completion of the Doulton Fountain restoration works and the surrounding park spaces, took place between 1993 and 2006.

2.1 Origins of the Restoration Scheme

In 1990 the Bridgegate Trust was commissioned to carry out a feasability study for the restoration of the Doulton Fountain including the installation of a water recirculation system. The report was not followed up.

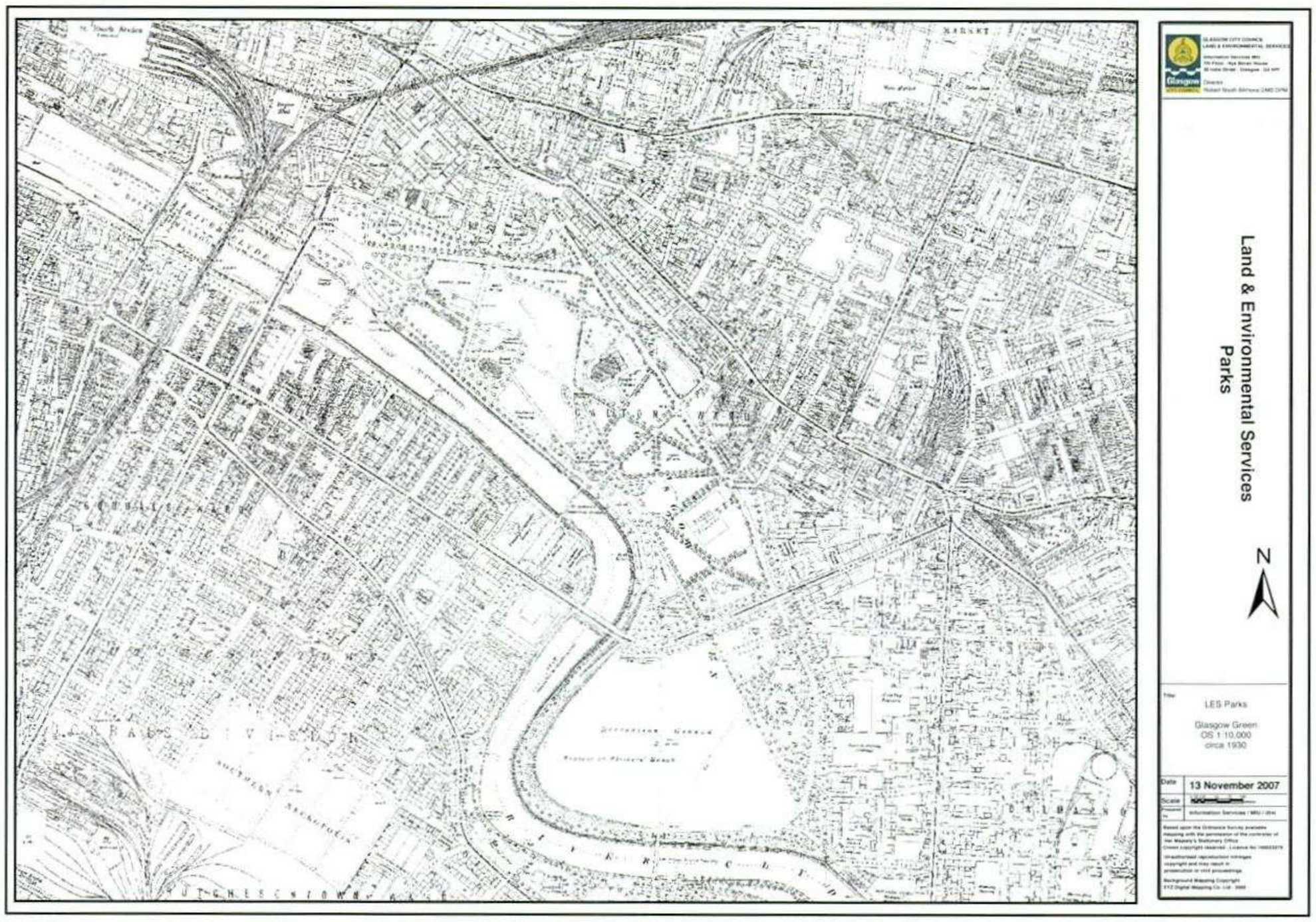
At this time members of the Parks and Recreation Committee asked for proposals for the regeneration of the Green. The brief was very generous in the aftermath of the Glasgow National Garden Festival held in 1988. Having received a presentation and armed with visitor survey information, part of the information gathering stage prior to the preparation of the Parks and Open Spaces Strategy, the Committee revised the brief seeking to return the Green of Glasgow Green to the people of Glasgow including the restoration of the Doulton Fountain.

In 1993 Glasgow City Council members requested a concept design and indicative costs for proposals for the redevelopment of Glasgow Green, Fleshers Haugh and Richmond Park.

GCC members established the principal aims for the renewal of Glasgow Green as follows:

1. To restore Glasgow Green to its status as the premier area of parkland in Glasgow.
2. To develop Glasgow Green's role as a city park with particular reference to its unique social importance in the evolution of Glasgow.
3. To secure the necessary enhancement of existing historic structures located within Glasgow Green. *(Glasgow City Council, "Glasgow Green Renewal Report", Supplementary Information Report 1 p.3, 1996).*

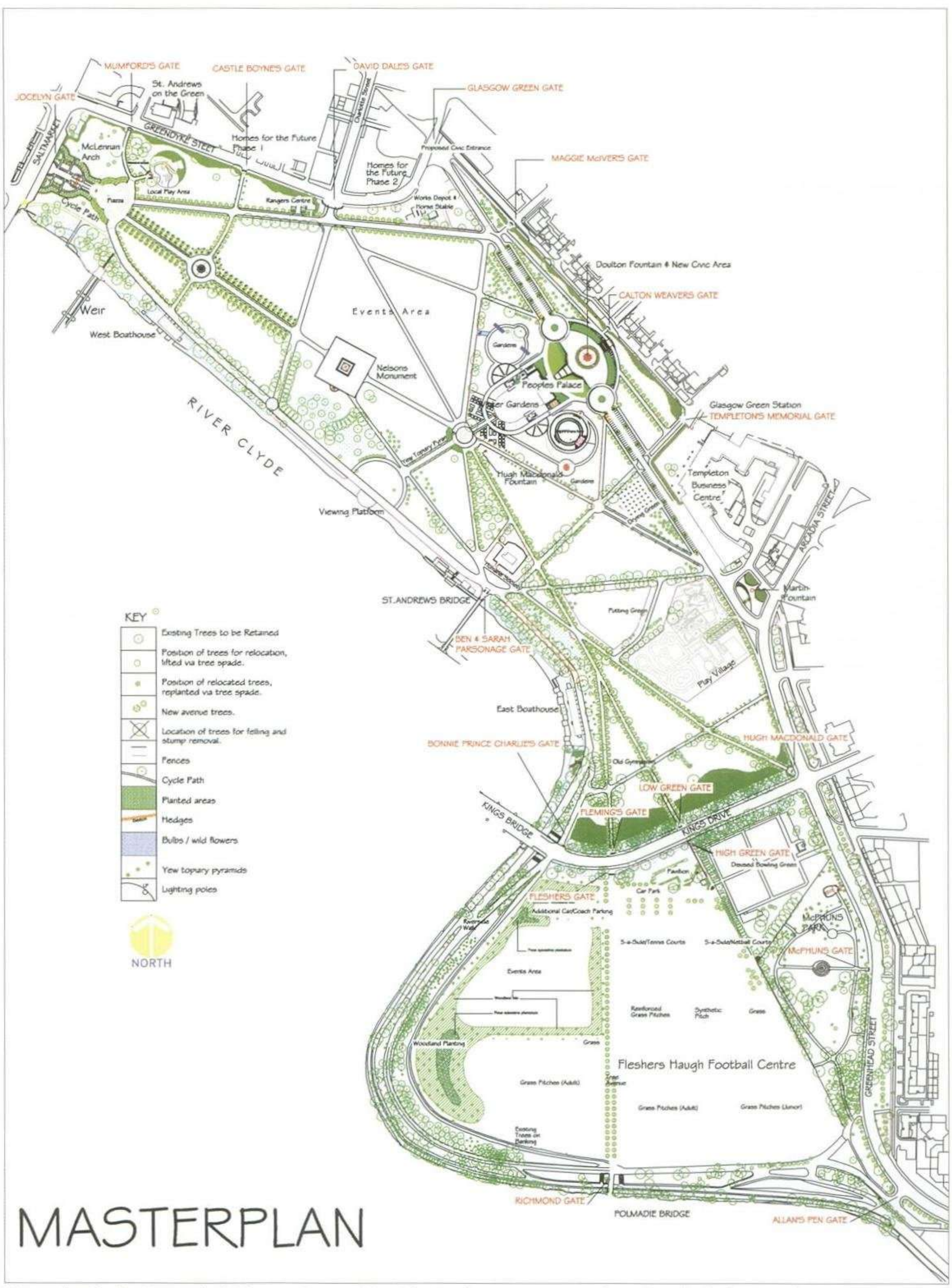
In May 1996 an application was submitted to the Heritage Lottery Fund for the Renewal of Glasgow Green. This was followed by two supplements which provided more detail about specific issues and budget



Configuration of Glasgow Green, on the north bank of the River Clyde, before the 1996 renewal project began. (Galsgow City Council)

reviews. The success of the application was announced on 02 December 1997. There were differences between Scottish and Engish law which delayed legal processes. The agreement was concluded in November 1998. The agreement included a valuation of the heritage merit of Glasgow Green.

- The instigator and overseer of the Glasgow Green Renewal Project was GCC Land Services.
- The overall scheme for Glasgow Green was designed by GCC Land Services.
- The design of the processes and the preparation of the documentation for the restoration of the Doulton Fountain was prepared by Building Services (Architectural Conservation and Design Team) of GCC.
- The design of the civic space outside the People's



Masterplan for the Renewal of Glasgow Green 1996. The Doulton Fountain is relocated at the focal point of a new civic space at the front of the People's Palace. *(Glasgow City Council)*

Palace and surrounding the Doulton Fountain was done jointly by Land Services and Building Services, GCC.

- The pre-construction phase regarding the monuments was undertaken by GCC Building Services. It was their role to establish the construction strategies, prepare documentation and to launch the tendering of the works for the historic structures, including the Doulton Fountain.
- The construction phase was also overseen by Building Services.

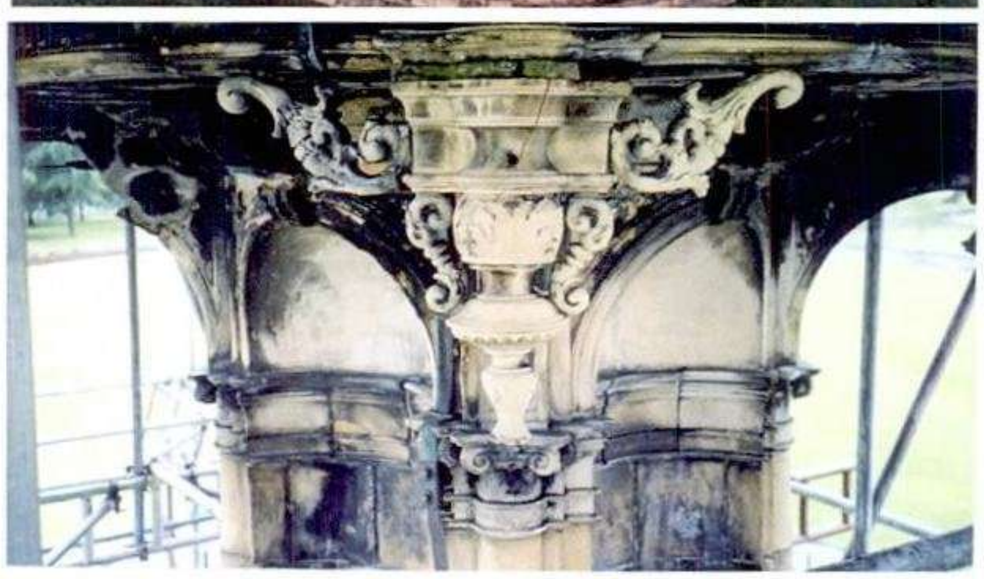
From the beginning, partnership working between contractors and the Council service departments was promoted as it was seen as essential to delivering the excellence demanded by the project.

2.2 Condition of the Fountain in 1999

By 1999 the Doulton Fountain's condition had degenerated seriously. The principal causes of deterioration were weathering of under fired terracotta, frost, the expansive effect of corrosion of the embedded steel structure, lack of maintenance and vandalism.





Examples of the conditions found on the Doulton Fountain at the commencement of the restoration project. *(All photos: Nicola Ashurst)*

2.2.1 Condition of the Sculptures

i) Victoria

The sculpture of Victoria had suffered localised loss of details in exposed positions such as the top of her orb, shoulders and other sky-facing extremities. This had also caused a swathe of green staining down the back of the sculpture which had developed along the route of the copper conductor cable.

(Nicola Ashurst)

ii) The Water Bearers

Most sky facing surfaces of the Water Bearers had been completely destroyed. Frost had affected most other surfaces leaving many of these in a deeply granulated, spalled or fractured state. The effect of the 1894 lightning strike had also taken its toll in the form of deep multiple layers of parallel spalling, and these had been exploited by the weathering.

(Nicola Ashurst)

iii) The Military Figures

The four Military Figures had been protected by the cantilevered course above them and their recesses. Consequently, they had experienced minimal damage due to weathering and this was concentrated on extremities and sky-facing surfaces such as tops of shoes and bases. Vandal damage was the most prevalent form of damage.

- The head of the Royal Irish Fusilier had been detached from his torso by vandals and could not be located. Localised weathering damage had taken place to his shoulders. The butt and bayonet off his gun were missing.

(Nicola Ashurst)

- The Sailor's head had been detached and lost. Small details such as the rope to his shirt and parts of his garment were missing from his torso. A few extremities of his torso were weather damaged.
- The torso of the Grenadier Guardsman had been smashed by vandals. Some pieces of it were found about the fountain. The top of his legs had been fractured but beyond that remained intact. The lower part of his rifle was also lost and unfortunately missing from all archive photographs.
- The Black Watch Highlander was largely intact with small details such as parts of his gun being missing.

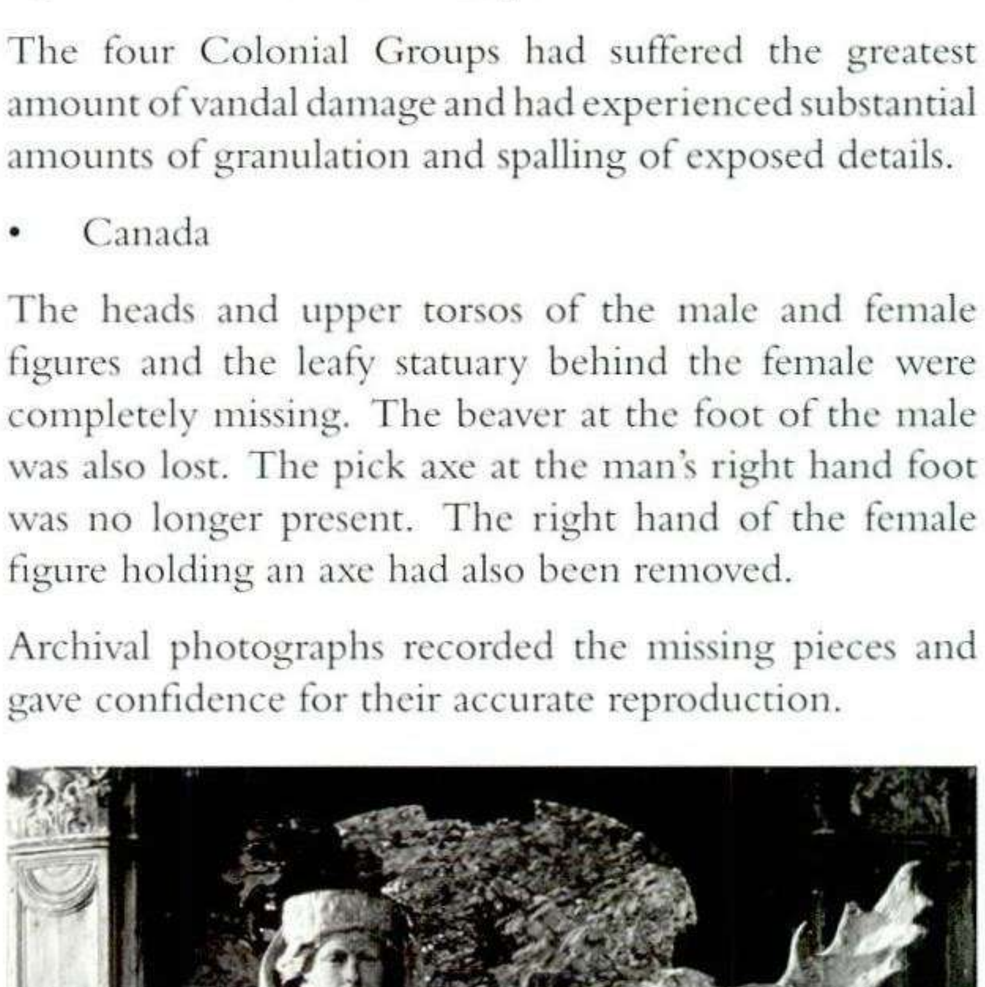
iv) The Colonial Groups

The four Colonial Groups had suffered the greatest amount of vandal damage and had experienced substantial amounts of granulation and spalling of exposed details.

- Canada

The heads and upper torsos of the male and female figures and the leafy statuary behind the female were completely missing. The beaver at the foot of the male was also lost. The pick axe at the man's right hand foot was no longer present. The right hand of the female figure holding an axe had also been removed.

Archival photographs recorded the missing pieces and gave confidence for their accurate reproduction.



(St Mungo's Museum, Glasgow)

- India

Probably the most heavily vandalised of the colonial groups, nearly all the pieces of India were either missing or severely damaged. Missing were the upper halves and heads of the male and female figures, the axe behind the man and the tree behind the female. Parts of the upper torso and arm of the woman were found in store along with fragments of the male tunic from the waist downwards and a few fragments of his left arm, some pieces of the plinth, including the female's right toes, the female's hand and a fragment of vase. The column with figures seated on horses which had sustained a lot of peripheral damage to the heads and upper torsos of the riders, was found in the sump of the external chamber.

(Hathernware)

An archival photograph of the India group existed from which it was confident missing or damaged details could be reconstructed.

- Australia

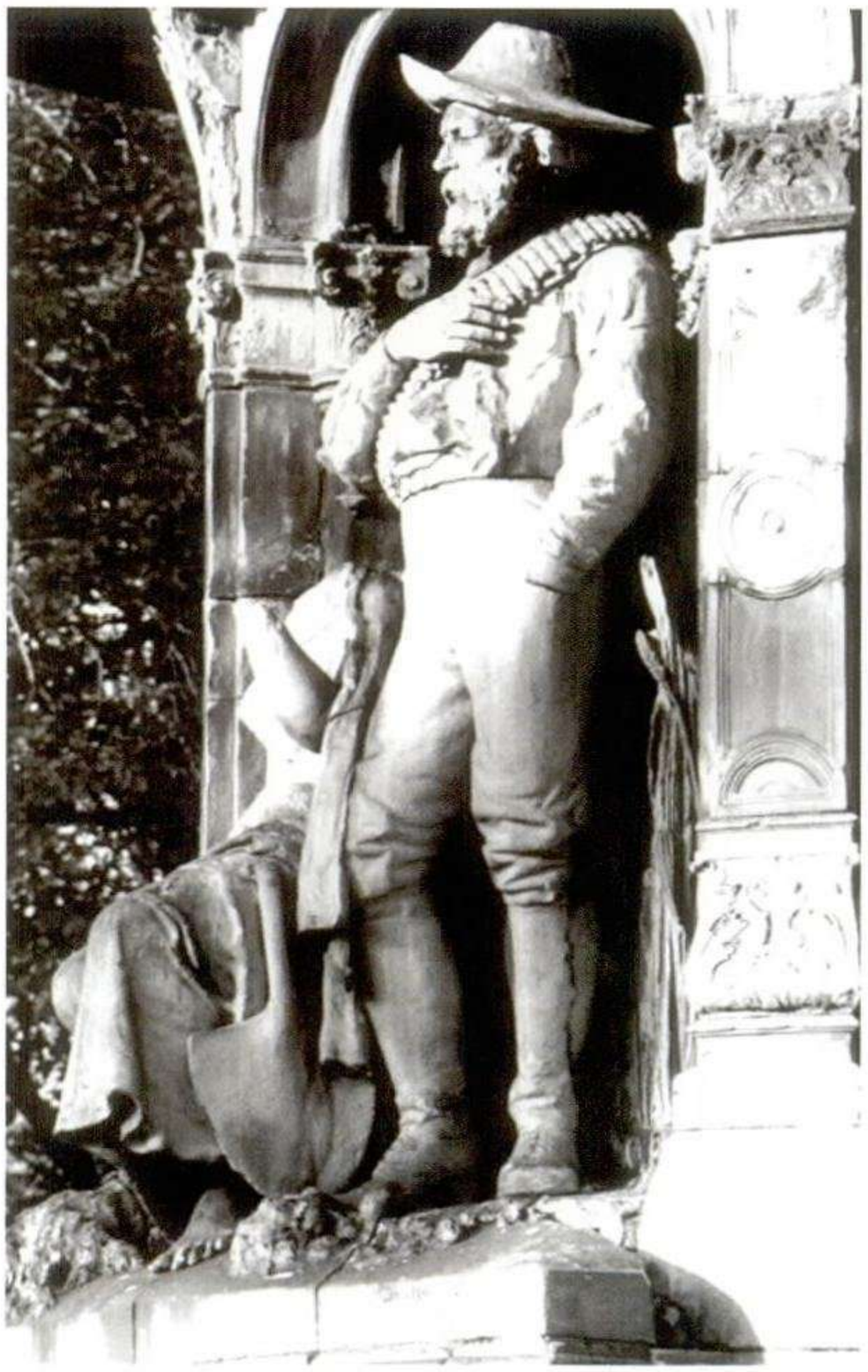
The upper half of the female figure (minus the head and right arm) had been found and retrieved from the sump behind the sculptures in July 1999. In store were the majority of the man's head and hat, the man's two arms, fragments of the woman's head, the woman's right arm, the woman's left hand the fragment of which and part of the fern from behind the man. Lost was the shaft of the man's spade.

Good archival photographs existed and to give confidence that any lost or damaged details could be faithfully recreated.

- South Africa

The female figure had lost her head, left arm and shovel. Her head was found in store. The man's upper torso was found in store along with his head and hat, but these were in fragments. His rifle and left arm were missing as were the ostrich and flowers behind the figures.

Only one archive photograph of the group existed.



(St Mungo's Museum, Glasgow)

- Colonial Group Name Plaques

Beneath each colonial group was the name of the sub continent, continent or country from which they came. Although damaged, detail existed on the fountain or in the archives for these to be accurately remodelled.

(Nicola Ashurst)

2.2.2 Conditions of the Fountain Blocks

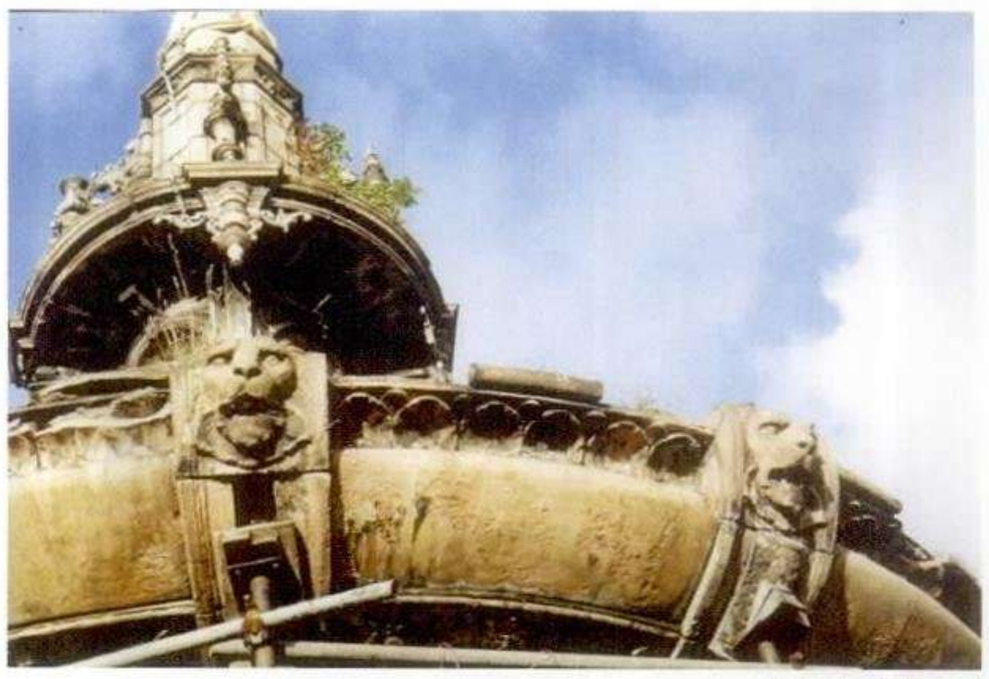
i) The Shaft & Niches to the Military Figures

Considering the degree of exposure, the terracotta at this level was in reasonable condition. The main type of deterioration was fracturing due to the embedded steel. The pink-coloured, under fired blocks were suffering granulation. The more yellow-coloured blocks to the shaft and decorative screens, possibly early replacements, were in much better condition.

ii) The Cantilevered Basin and Lion Heads

All the lion heads and associated moulded terracotta which clad the circular perimeter beam had fractured and many pieces had detached and fallen. All the pieces covering the ribs and supporting the infill panels had also fractured due to the corroding iron arms. The plain and decorative panels between the ribs had been affected in part by the corroding ribs but also had experienced granulation due to being insufficiently fired, frost and soluble salts.

(Nicola Ashurst)

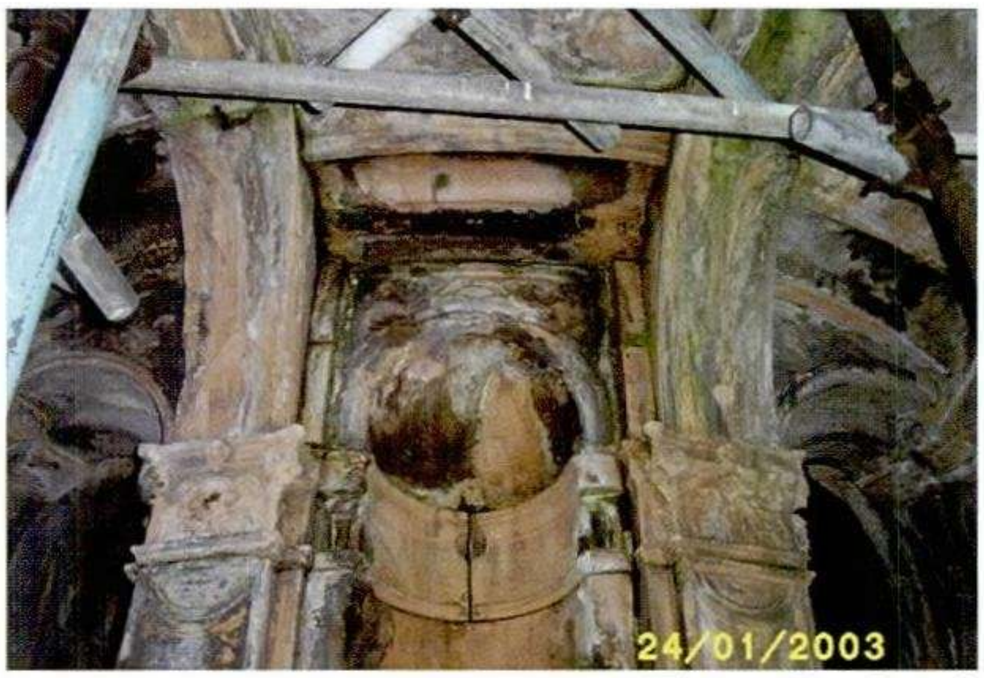


(Nicola Ashurst)

iii) The Bat-Head Niches

Between each sculptural group was a niche with tracery. The upper part of each niche contained a lyre-shaped tracery surmounted centrally by a creature that looks like a bat's head with wings. A jet of water originally exited through the mouth of the creature.

Archive photographs and photographs taken by members of the public in the 1970's and 1980's, as well as the one bat's head that remained and fragments of the tracery, provided the evidence so these elements could be accurately replicated.



(Glasgow City Council)

Details of the bat-head niches and the inner basin wall.

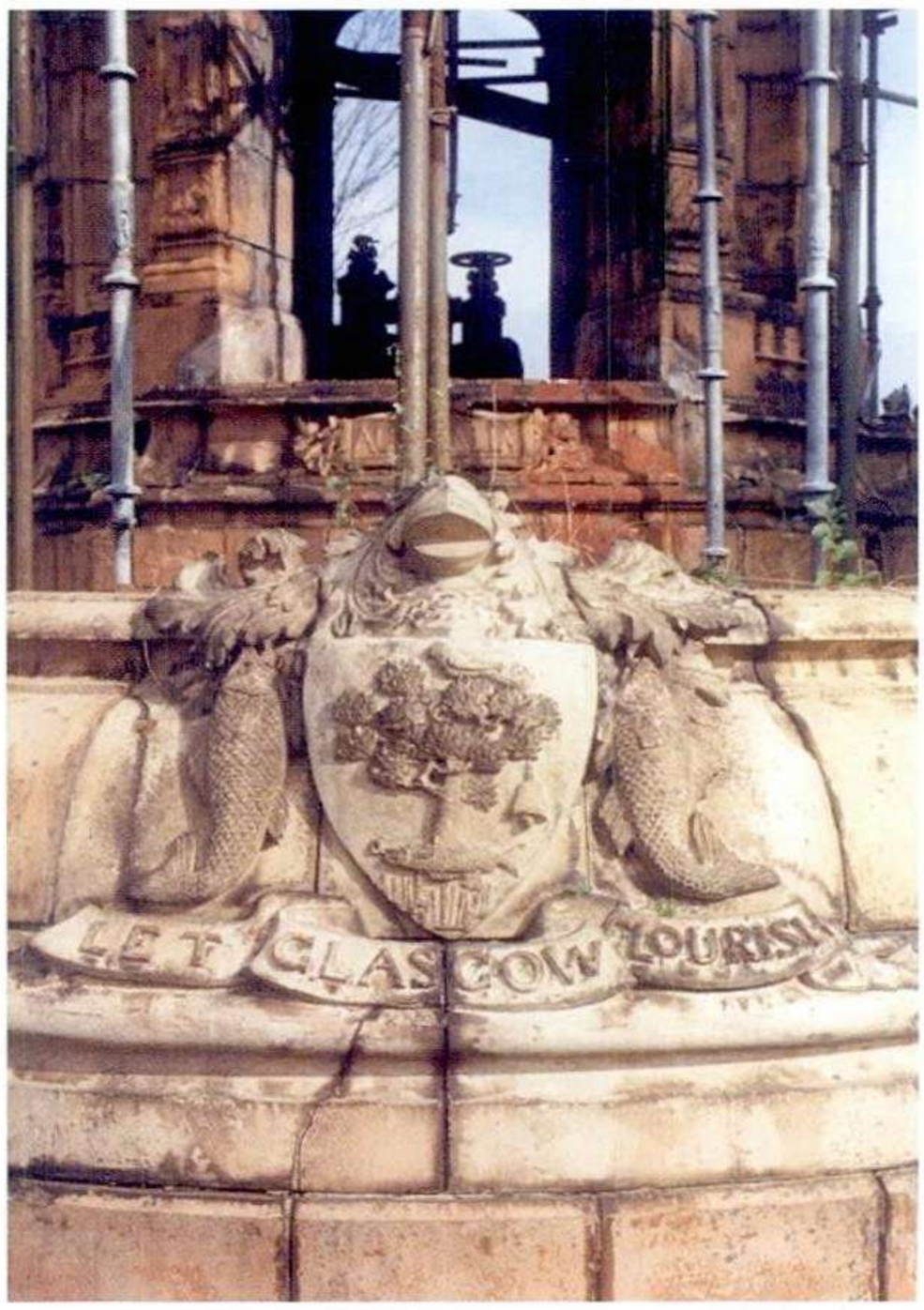
(Hathernware)

iv) The Inner Basin Wall

The condition of terracotta blocks to the inner basin wall was varied. Fortunately most of the original terracotta to the basin which immediately surrounded the colonial groups remained intact and no element was entirely missing.

The Glasgow Coats of Arms situated beneath each colonial group had minor damages. All four torsos of the surmounting figure of St. Mungo had been damaged or removed. Archive photographs showed St. Mungo to have originally worn a Bishop's mitre, held a crosier in his left hand and to have his right hand held probably in a sign of peace.

(Nicola Ashurst)



(Nicola Ashurst)

v) The Internal Chamber

The internal chamber contained the original water pumping system in a corroded and dysfunctional state. The terracotta lining the chamber was largely intact.

vi) The Outer Basin Wall

Many of the square plinths dividing the wall into its twenty four bays had lost their tops.

All eight of the original urns were missing.

One of the die stones in front of the India sculpture once held a presentation plaque inscribed 'Presented by Sir Henry Doulton to the City of Glasgow 1890'. (Ballin Smith, 1999). This had been replaced in a plain panel of terracotta of a pronounced yellow colour, along with select other blocks to the outer basin wall. Many of the blocks to the wall also experienced well developed frost damage.

2.2.3 Condition of the Iron Structure

The cast iron columns, wrought iron brackets and arms, the flat plate perimeter beam and the wrought iron tie rods were corroded in varying degrees but in sufficiently good condition to retain and repair locally.

2.2.4 Protecting the Sculptures

To avoid further deterioration and damage, the sculptures were removed from the fountain structure and put into store.

The military figures and the colonial groups were removed in 1999 by Hunter and Clark, the stonemasonry firm under the supervision of GUARD.

The Water Bearers were taken down in June 2002 also by Hunter & Clark under the supervision of GUARD. By that stage the sculpture conservator had been appointed and was present to stabilise very delicate surfaces of the figures before they were detached and moved. Without this many areas of heavily damaged original detail would have been irretrievably lost.

Victoria was taken down as part of the overall dismantling of the fountain which began in December 2002. The removal prior to this would have destabilised the fountain structure.

Construction of the outer basin wall. *(Glasgow City Council)*

2.3 The Nature and Decay of Terracotta

2.3.1 History and Description

In Italian, "terracotta" means "baked earth or clay".

Terracotta is one of the oldest building materials known to man and was used in Babylonia as early as 1400 BC. In England the craft of terracotta manufacture dates from the period of Roman occupation and although little survives the intervening years, terracotta appears in some notable buildings of the C16 such as Nonsuch Palace, Sutton Palace and Hampton Court. Terracotta was not to find its place in the UK market again for a further 200 years when Coade's Artificial Stone Manufactury was established in 1769. Out of this grew an industry which gave birth to what is generally described as architectural terracotta.

Today the term terracotta is most commonly used to refer to unglazed fired clay building units and the term "faience" used to refer to glazed fired clay units. Both can be either load bearing or cladding building materials. Terracotta also has a history of use in decorative figures.

Terracotta and faience are moulded clay products made from fine, pure clays mixed with other materials such as sand and previously fired clay (grog). They are formed into building units about the size of those used in traditional stonework. The units have a hardness, compactness and sharpness of detail not normally obtained with brick. Methods of construction and modes of deterioration and weathering are also different to brick and most other traditional masonry materials.

In 1886 James Doulton provided the following definition of terracotta:

> *'That class of ware used in the construction of buildings, which is more or less ornamental, and of a higher class than ordinary bricks, commanding more care in the choice and manipulation of the clay, and much harder firing, and being, consequently, more durable and better fitted for moulded and modelled work'. (as quoted in: Stratton, M.J. "The Terracotta Revival" Gollancz, London, 1993, p.13)*

During the late C19 terracotta was promoted as a solution to some of the most pressing problems encountered in urban building – smog, decay and the cost of natural stone.

The Victorian period saw tremendous interest in the use of terracotta in the fabric of prominent civic buildings such as the Victoria and Albert Museum, The Royal Albert Hall and the Natural History Museum in London. By the late 1870's Doulton was a leading manufacturer supplying terracotta for major buildings.

Only in the early 1980's did terracotta begin to be valued at the same level as brickwork and stonework, and to therefore be in need of authoritative assessment and specialist repair and conservation works.

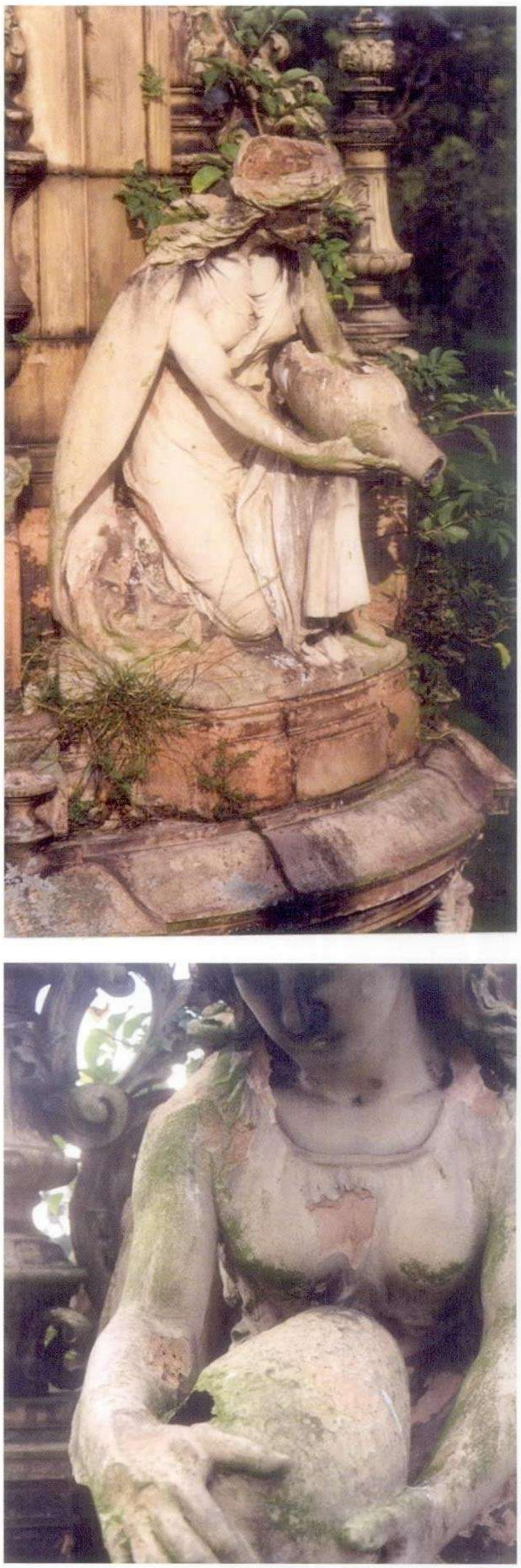
2.3.2 The Decay of Terracotta

There is a clear correlation between the amount of vitrification clay body achieves due to higher firing temperatures and its durability.

The paler pastel colours of terracotta favoured by the Victorians, and prevalent on the Doulton Fountain, could only be achieved by firing at lower temperatures that did not impart the same level of frost resistance as higher temperatures. The spalling and granulation which results in low-fired blocks encourages further water penetration and frost damage particularly in areas where the terracotta is exposed to the weather. In protected areas, soluble salt accumulation leads to soluble salt crystallisation damage and pulverisation of the terracotta surface.

Terracotta is a seemingly robust, but brittle material. It is easily damaged by impact and the tensile forces caused by structural movement and the corrosion of internal iron or steel armatures. Many terracotta buildings and structures of the late C19 were built in cementitious mortars which produced a very rigid form of construction. Terracotta was unable to accommodate the tensile stresses which resulted.

The fact the Doulton Fountain only operated originally during four of the warmer months of the year would have reduced the amount of damage caused due to frost action and water saturation of the terracotta. There is, never the less, widespread deterioration due to under firing alone.



Details of the deteriorated condition of the four Water Bearers. Fracturing, delamination, frost damage and surface granulation were widespread.

(All: Nicola Ashurst)

3 SETTING UP THE PROJECT

3.1 Pre-Contract Strategy

The first steps of the documentation phase of project involved

- The preparation of measured drawings of the fountain,
- Undertaking an archaeological survey of the fountain to understand its characteristics and condition.
- Archive research to establish details of its history which were not apparent of the fountain itself, and
- The appointment of specialist consultants to advise on the conservation and repair of the fountain and its sculptures.

The responsibility for the delivery of Glasgow Green Renewal rested with GCC Land Services. The project management structure recognised that of the five key activities, Landscape Design, Monument Restoration, Interpretation, Public Information and Management/ Maintenance the GCC Building Services Architectural Conservation and Design team possessed the necessary skills and experience to lead the restoration of monuments on the Green.

Heritage Lottery Fund appointed a Senior Monitor, Martin Tabor of Land Use Consultants and Eric Brookes of Conservation Specialists Ltd., a terracotta specialist. Both attended management team meetings and reported directly to Heritage Lottery Fund.

3.1.1 Photogrammetric Survey

As no record drawings were available to show the original detail and construction of the fountain, a photogrammetric survey was undertaken in 1999.

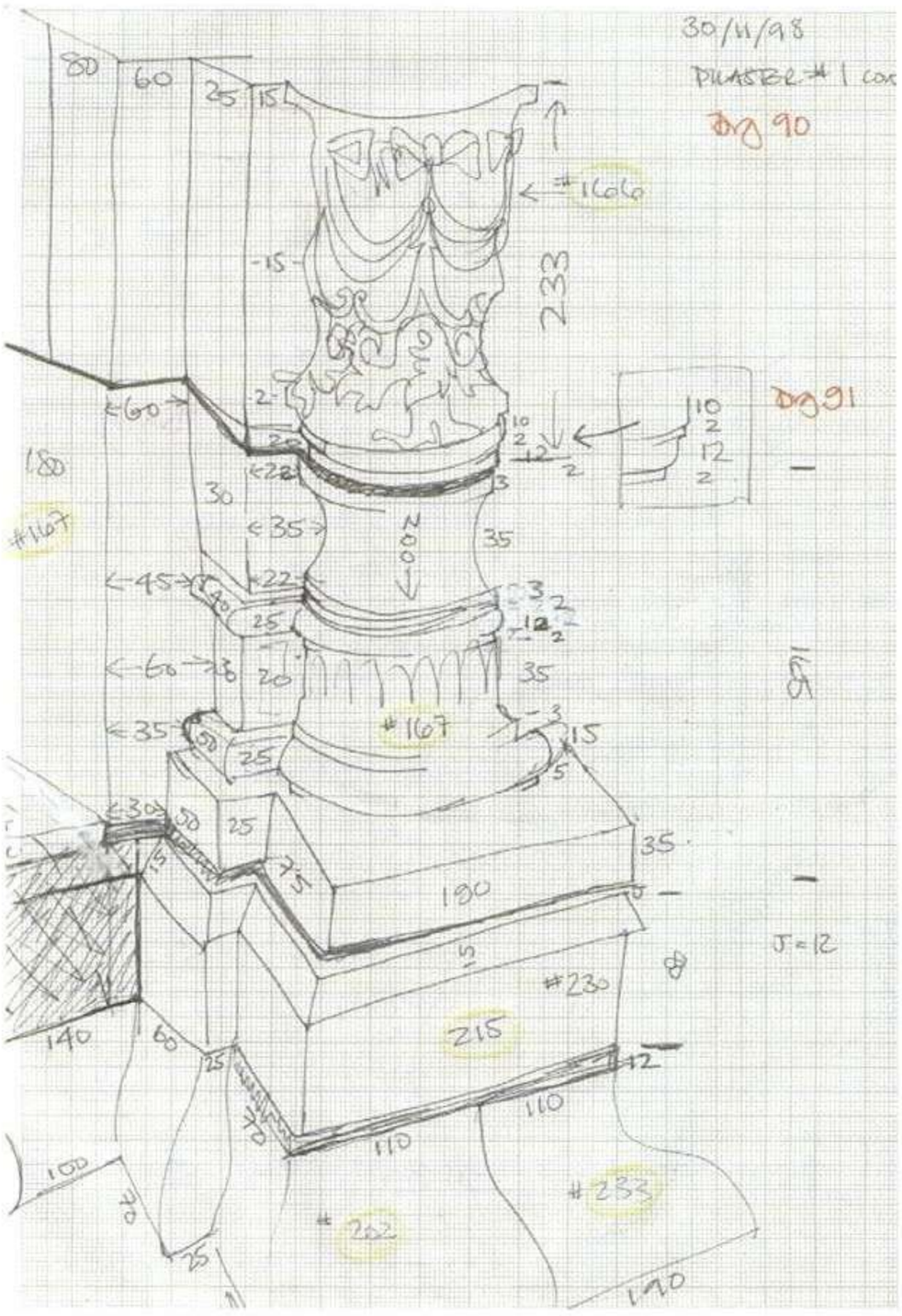
3.1.2 The Project Archaeologists

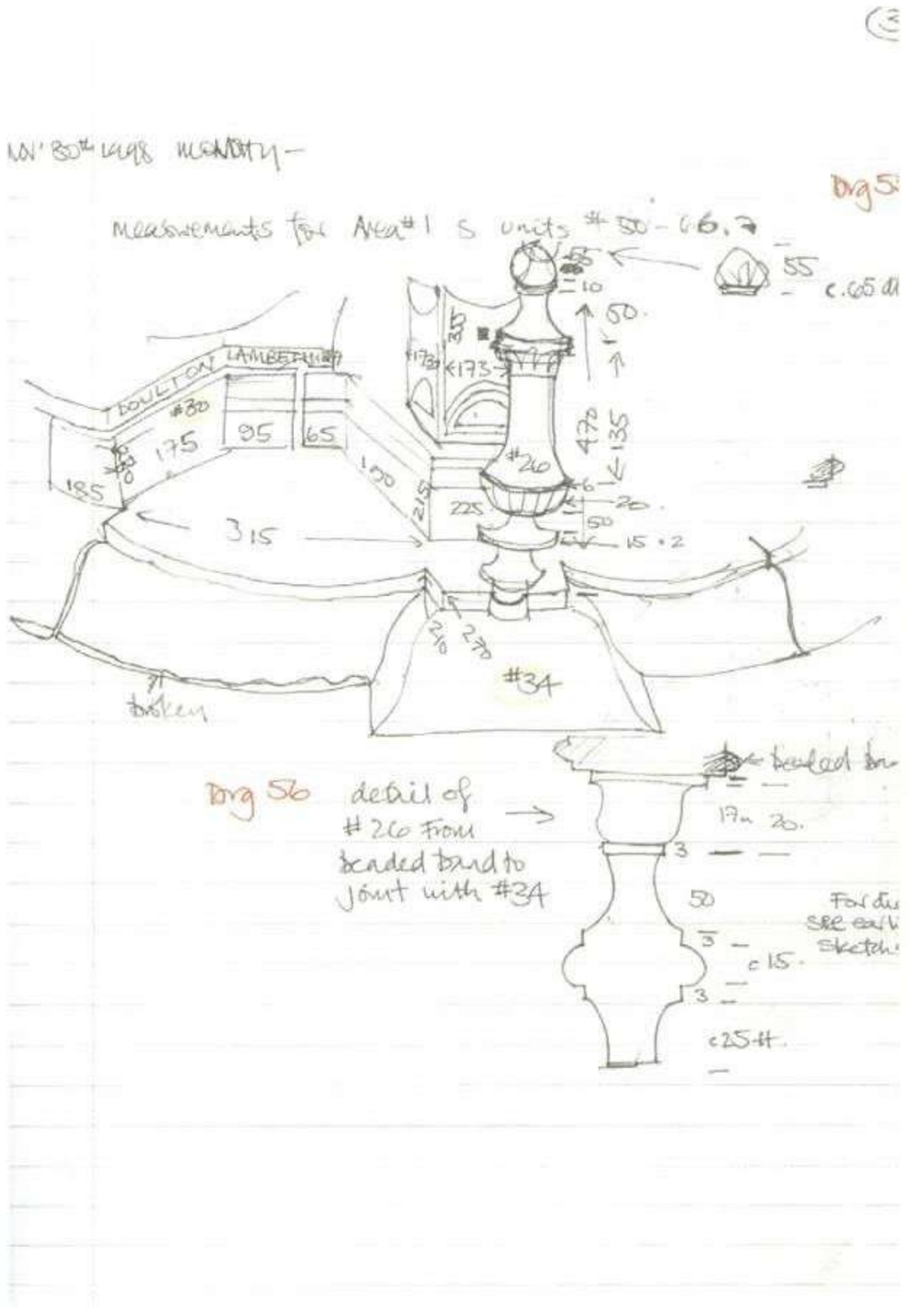
In January 1999 Glasgow University Archaeological Research Division (GUARD) was appointed to provide the following archaeological services to the Doulton Fountain Project:

- Taking the lead in recording the fountain's restoration from inception to completion.
- Providing a detailed survey and inventory of all components.
- Identifying all the components. This involved photographing and recording terracotta pieces and fragments already retrieved from the fountain and in store.
- Locating and identifying missing components.
- Providing archaeological services throughout the project.
- Maintaining archive records of the process of investigating, recording, tendering, dismantling and re-erecting the fountain.
- GUARD also provided archaeological backup advice to the architectural terracotta and the sculpture conservation consultants during their periods of assessment.
- GUARD played a key role overseeing the taking down of the military figures, the water bearers, colonial groups and their placement in store, as well as the taking down and packaging of Queen Victoria.
- GUARD oversaw the packing and scheduling of all pieces of sculpture which were transported from the Glasgow store to the terracotta manufacturer in Loughborough.

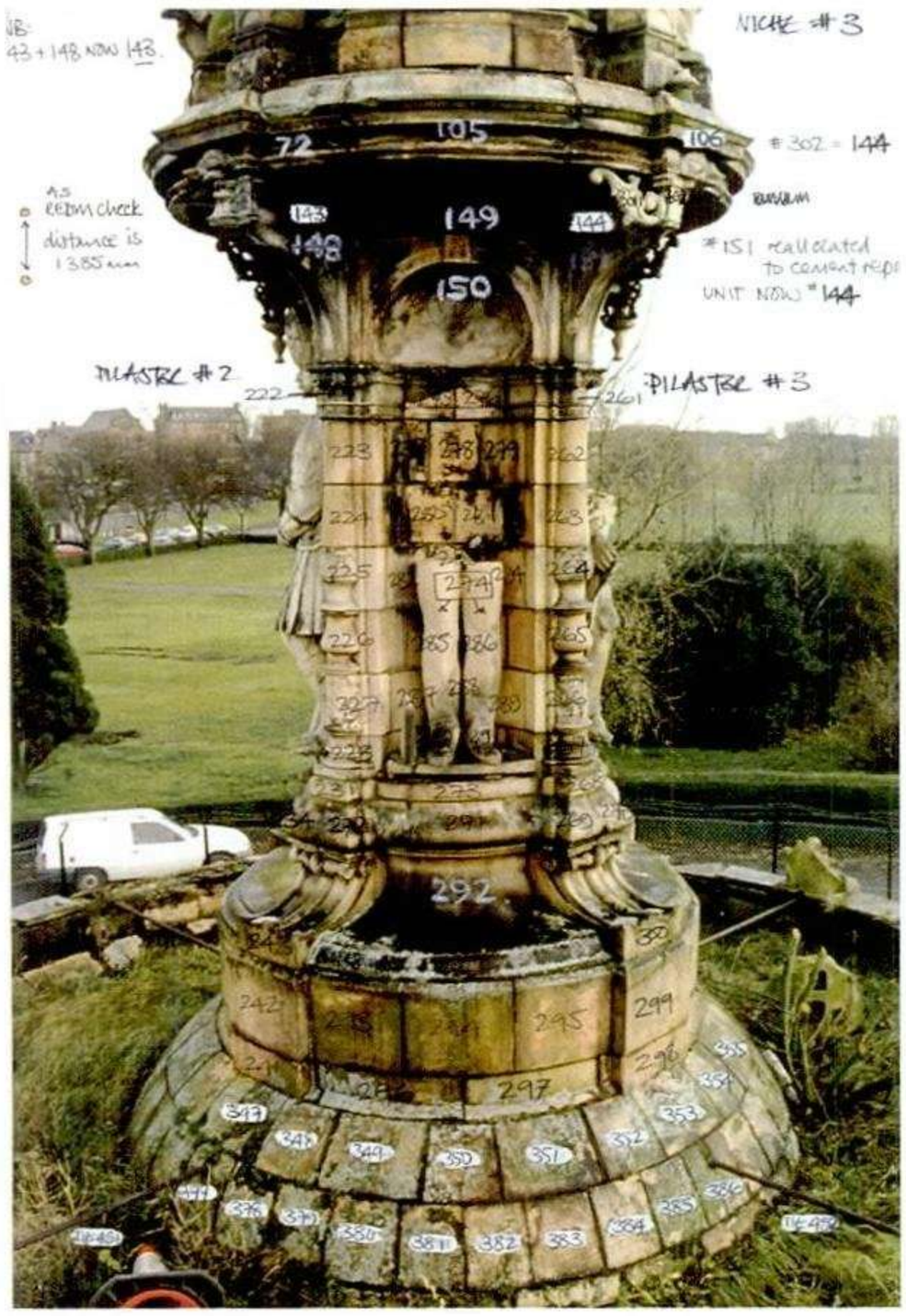
GUARD's first report (Ballin Smith, 1999) recorded the characteristics and condition of the fountain. The document was a pictorial archive of the fountain prior to it being dismantled, conserved and relocated. It included a photographic record and hand written record sheets of the individual elements making up the structure. The report also included topographic plans, sections and profiles through the fountain, achieved by laser survey and hand measurement. It incorporated photographs of pieces from the fountain then in store at Glasgow Museum Stores, Maryhill, Glasgow.

Each individual terracotta piece or block was given a number starting with Queen Victoria as number one. This numbering system provided the basis for all further numbering systems used throughout the project. The report was the documentary foundation to the rest of the project.



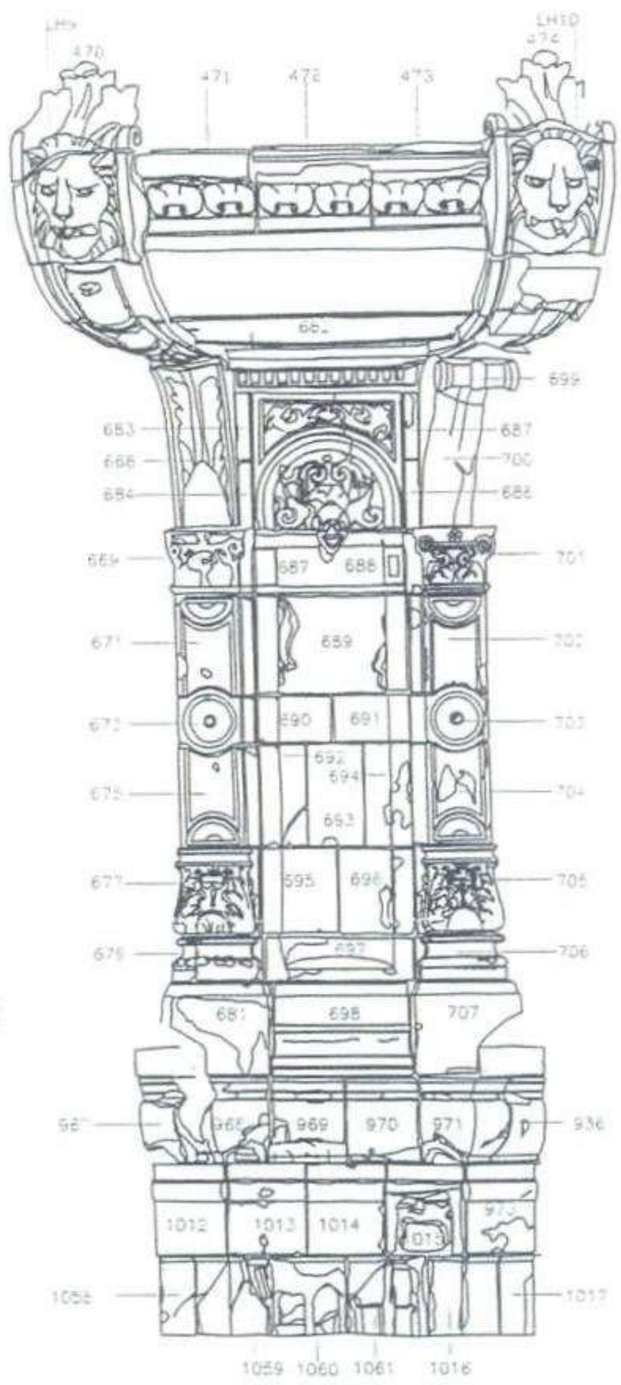


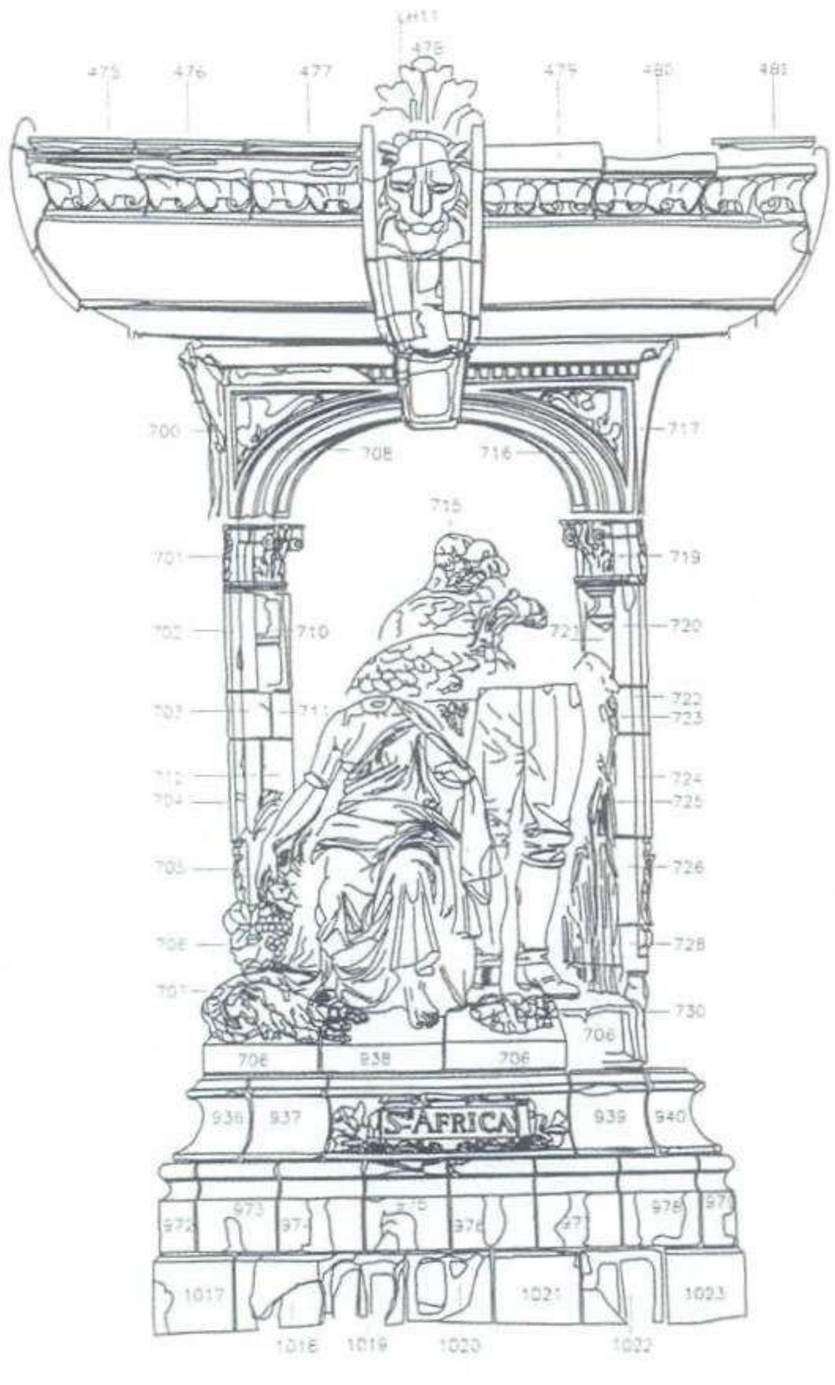
Detailed notes and sketches prepared by GUARD when recording the fountain in preparation for the detailed survey period.

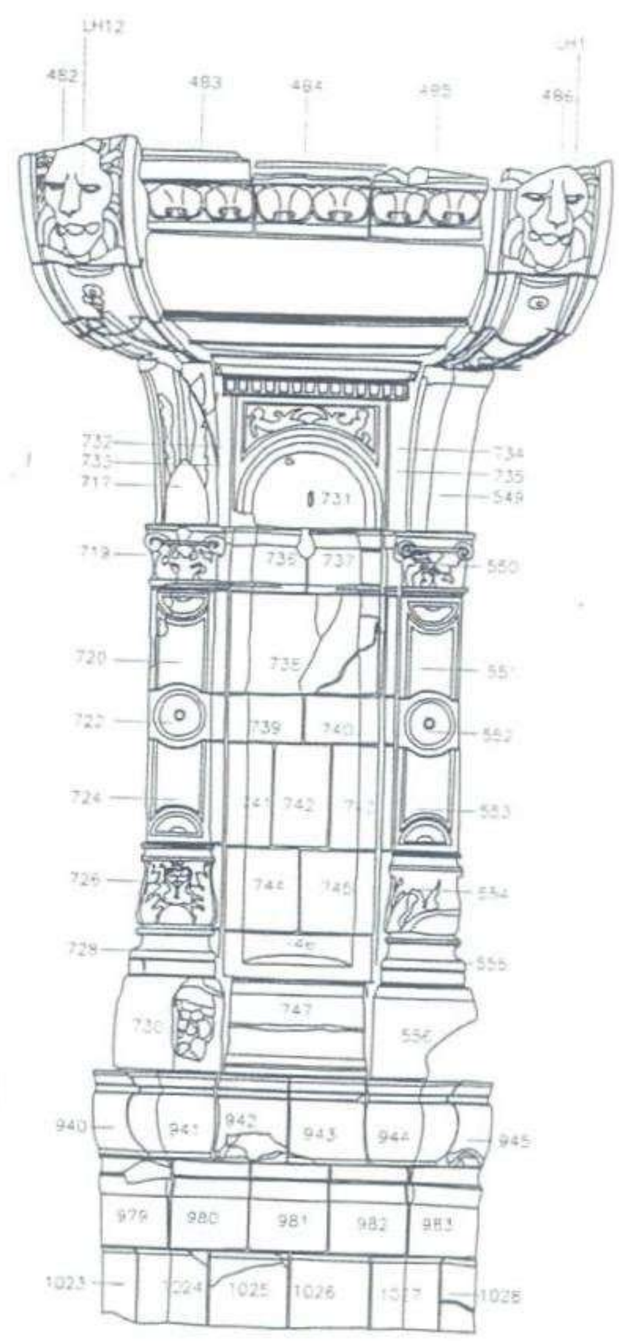


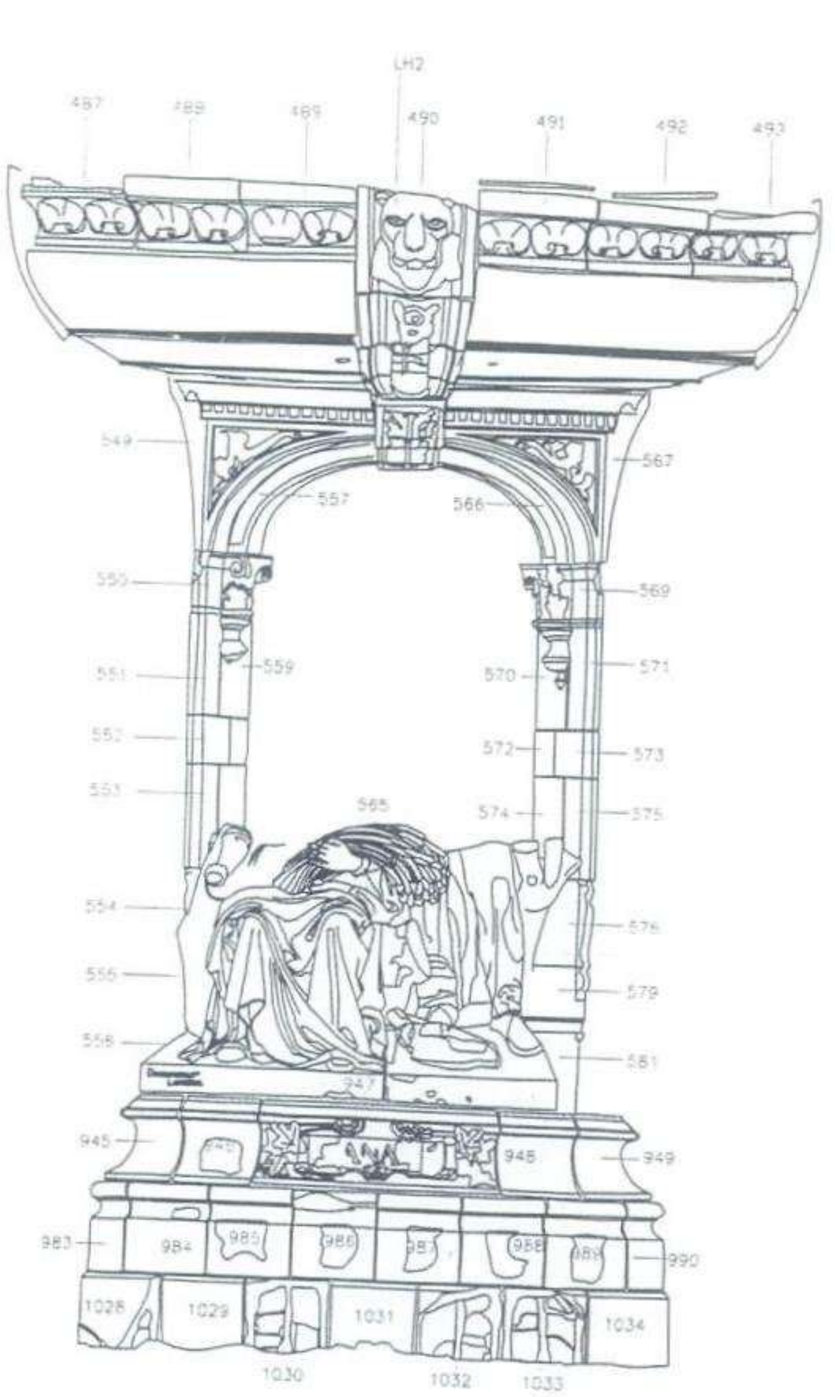
Examples of the individual block numbering system developed by GUARD.

GUARD's second report of 1999 (Evans, Arthur, Ballin Smith, Speller & Thomsett) provided a comparison between the Doulton Fountain in its neglected, pre-repair condition, and archive material. It included photographic evidence of sculptural details no longer on the fountain or in store. These proved invaluable for the entire decision making process, during the assessment period as well as the repair conservation and replacement works.









Architect's drawings of some of the block repairs scheduled for niches and piers between the colonial groups. *(Julian Harrap Architects)*

3.1.3 Specialist Consultants

In October 1999 Glasgow City Council appointed two specialist terracotta consultants:

- Julian Harrap Architects was appointed to advise on the condition of the terracotta blocks, and to prepare specifications and drawings for their repair and reinstatement.

  The Architects carried out an initial condition assessment of the fountain block work, categorising blocks for repair or replacement in new terracotta. They also provided initial construction drawings and specifications for the rebuilding. Both these documents formed the basis of the Bill of Quantities.

- Adriel Consultancy (Nicola Ashurst) was appointed to provide specialist input on the conservation and repair of the terracotta sculptures.

  Her brief was to provide a conservation strategy for the sculptures, to invite tenders from conservators to work alongside the terracotta manufacturer and to provide quality management of the conservation and restoration processes.

3.2 Strategy for Conservation and Repair of the Sculptures

The Adriel Consultancy commission began with the preparation of a conservation strategy for the sculptures.

The military figures and colonial groups which had been removed from the fountain and put in store were inspected in collaboration with GUARD, along with pieces which had been collected from around the fountain. The Water Bearers and Queen Victoria which remained on the fountain were inspected from a cherry picker.

3.2.1 Conservation Parameters

The preliminary strategy for the conservation and repair of the sculptures was prepared in November 1999. (Adriel Consultancy, 1999).

The following parameters were used to assess each sculpture group

- Whether localised repair or conservation techniques would be appropriate for the making good of damages and defects.
- Whether localised repair would be suitable for pieces to be returned to external conditions in a working fountain.
- Whether figures needed to replaced in part or in whole.
- Whether parts of figures, either original construction joints or at newly formed interface joints, could be replaced in new terracotta.
- What the final appearance of the sculptures as individual pieces and as parts of their groups would be.
- What appropriate repair and replacement materials would be and how these would weather and soil in comparison with the host terracotta.
- It was considered of paramount importance that as much as possible of the original sculptures were retained particularly as they had been modelled direct rather than being finished after formation in a mould.

Throughout the assessment procedures the archival documentation collated by GUARD and photographic evidence retrieved from other sources were constantly referred to. These were particularly relevant when determining whether sufficient evidence existed which would enable a confident replication of missing or damaged pieces.

3.2.2 Conservation Strategies for the Sculptures

i) Queen Victoria

The figure of Victoria, reported to be a replacement of the original following the 1894 lightning strike, was made of a terracotta which was more resilient to the weather conditions than figures elsewhere on the fountain.

It was found that the figure could be retained as a whole with localised repairs to small areas of loss. The separate pieces of the hands and batten needed to be investigated to ensure they were secure. The existing lightning conductor needed to be removed to enable the crown to be reconstructed and repaired.

ii) Water Bearers

All four Water Bearer figures were in extremely poor and delicate condition. Their terracotta was under fired, affected by the lightning strike, severely weathered and had more than exceeded its lifespan.

Had the terracotta quality been better, loss of detail to areas such as the tops of heads and backs, the water urns could have been made good by localised repair techniques. However, close inspection of each of the figures confirmed that all remaining surfaces were riddled with small fractures and other forms of surface breakdown, to the extent that their repair, even for retention in an internal environment, would be extremely difficult to achieve. Their condition was so delicate that even before they were taken off the fountain widespread stabilisation techniques needed to be undertaken to avoid extensive loss of original material.

iii) Military Figures

- The Royal Irish Fusilier required a new head in terracotta, localised repairs to his torso, legs and base and replacement of the bayonet and other missing sections to his gun, in terracotta.
- The head, torso, legs and face of the Black Watch Highlander required localised repairs. His bayonet needed to be replaced in terracotta.

The damaged legs and gun of the Royal Irish Fusilier. (Nicola Ashurst)

- The many pieces of the head and torso of the Grenadier Guardsman could not be repaired. Replacement was necessary. The bayonet to his gun was replaced. The legs could be retained, requiring localised repairs to the top of the legs and the rear of the base.
- The figure of the Sailor required a new head to be fitted to the original torso, the torso itself requiring replacement of several peripheral missing details. The legs, base and gun of the sailor could be retained with minor repairs. The top of the gun required replacement in terracotta.

iv) The Colonial Groups

The sculpture groups were made of several pieces, each of which received detailed assessment.

- **Canada**

The missing pieces requiring replacement in terracotta were:

- The man's head and torso.
- Man's right arm and gun.
- Man's left arm and sleeve.
- Moose antlers.
- Lady's head and torso.
- Ivy plant behind woman's head.
- Lady's right hand and attached axe.
- Front of base beneath the woman.
- Stone and associated front of base.
- Beaver and associated front of base.

The following original pieces could be retained and repaired as follows:

- Moose head and attached man's hips: the piece could be retained and have two new terracotta antlers attached.
- Man's legs: required localised repair to the sky facing surfaces (frost affected), to splits and supports to the legs and to granulating surfaces to recesses.
- Lady's lap, legs and wheat sheaf: extensive localised repairs to frost affected, salt affected and soiled areas.

Pieces to the rear required minor localised repairs.

- **India**

Pieces of the man which required replacement were:

- The axe handle and the right hand section of the base.
- The man's torso was in a multitude of pieces, the five largest pieces comprised his right hand and the front of his right shoulder and chest as well as parts of his belt. The remaining pieces, which had been stored in a cardboard box were down to 25mm x 38mm in overall size. The pieces were reconstructed to enable accurate replication.
- The man's left leg and part of the base: The quality and condition of the terracotta was too poor to repair. Replication was recommended.
- Chain mail, bag and man's right leg: These would require a substantial amount of localised repair. It was considered that the effort needed to be made as this was one of the few remaining pieces of original terracotta to the India Colonial Group. The quality of the workmanship on this particular piece was exceptional.
- The column with riding figures: Most of the column remained in reasonable condition with chips and spalls to peripheral detailing. It was recommended that the decapitated riders and horses should be replaced in terracotta, and attached to the original column.

The highly detailed original head of the Indian lady. *(Cortauld Institute)*

The Lady

- The lady's torso remained in fragments; parts of the jewellery to her neck, right shoulder, left shoulder and the front of the dress could not be found. Most of her right arm, right torso and left arm were missing. Insufficient pieces of the original remained and very poor quality of those that did remain led to the recommendation for replacement in terracotta. It was acknowledged that this would need to rely on the archival evidence which had already been found.
- A large portion of the piece forming the lady's lap, legs and drapery was in extremely poor condition (friable, flaking and/or split). The quality of the original terracotta was not sufficiently good to provide a sound substrate for widespread localised repairs. The final recommendation was that the piece be replaced.
- The lady's head was missing and required replacement.

- **Australia**

The Lady:

- The whole piece needed to be replaced in terracotta as substantial parts were missing.
- The lady's torso with left arm and wheat sheaf attached could be retained with localised repairs but required replacement of the missing left hand and bottom of the wheat sheaf.
- The lady's dress and part of the base could be retained using localised repairs.
- Of the lady's right arm only the lower arm remained with the right hand and sheep horn missing. It was recommended that these pieces be replaced in terracotta.

The Man:

- Most of the man's head and hat remained requiring localised repairs to the missing parts of the hat rim.
- The man's left and right arms, in three pieces, were the only pieces of his torso to remain. The full piece needed to be replaced in terracotta.
- The man's lap, legs and feet could be retained with localised repairs.
- Pieces to rear of sculpture, these could be retained with minor localised repairs.

The Sheep:

- The original pieces could be retained with localised repairs.

- **South Africa**

  The Man:

  - The man's head was in 31 pieces. It was recommended that these be reconstructed to form the basis of replacement of the piece in terracotta.
  - The man's torso including the bullet belt and right arm was in sufficiently good condition to be retained with localised repairs.
  - Replacement of the man's left arm and rifle in terracotta were required.
  - The man's legs could be retained with localised repairs.

The Lady:

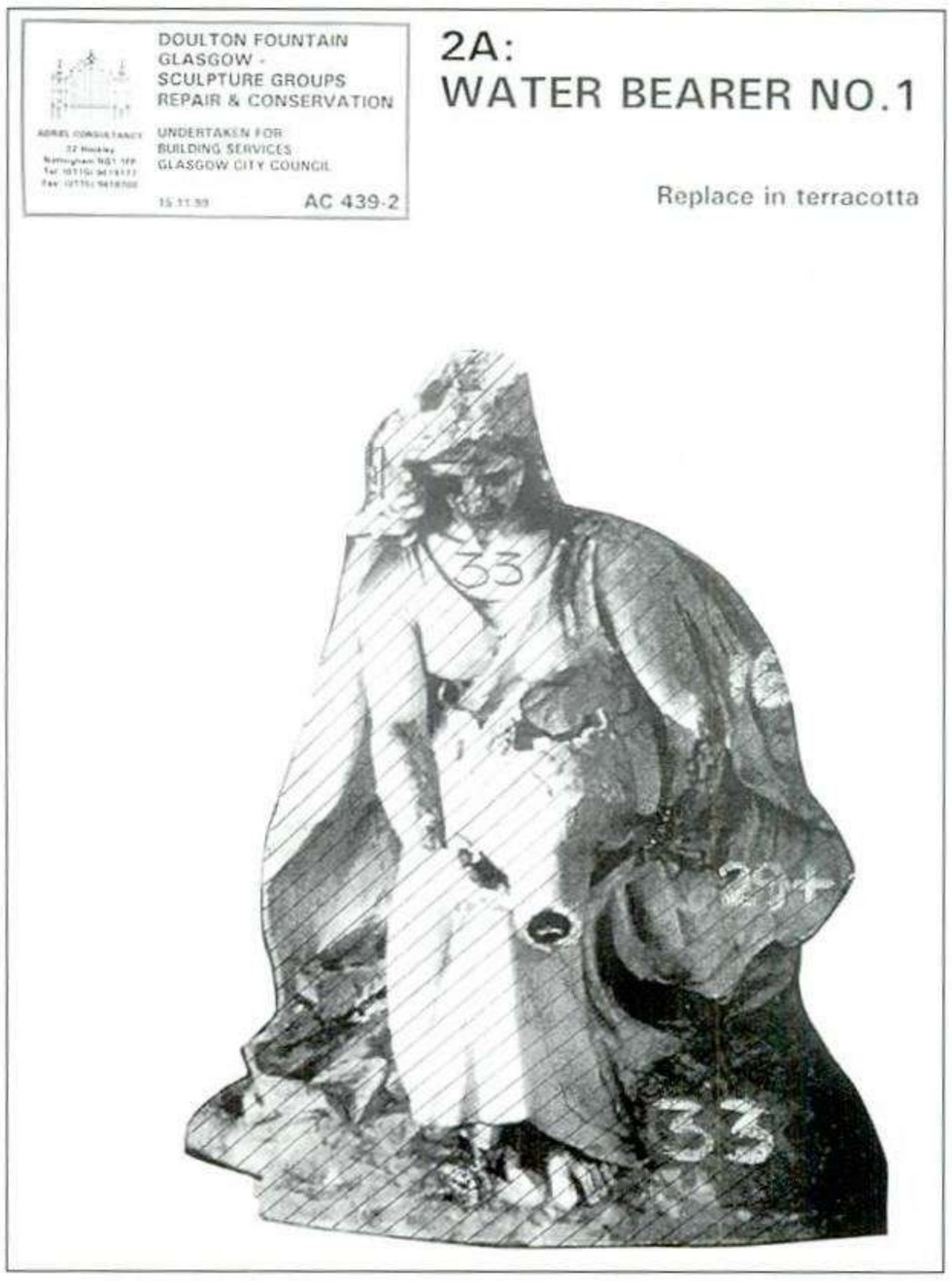
- Her head required localised repairs as did her torso, lap and legs and all four pieces of the base at her feet.

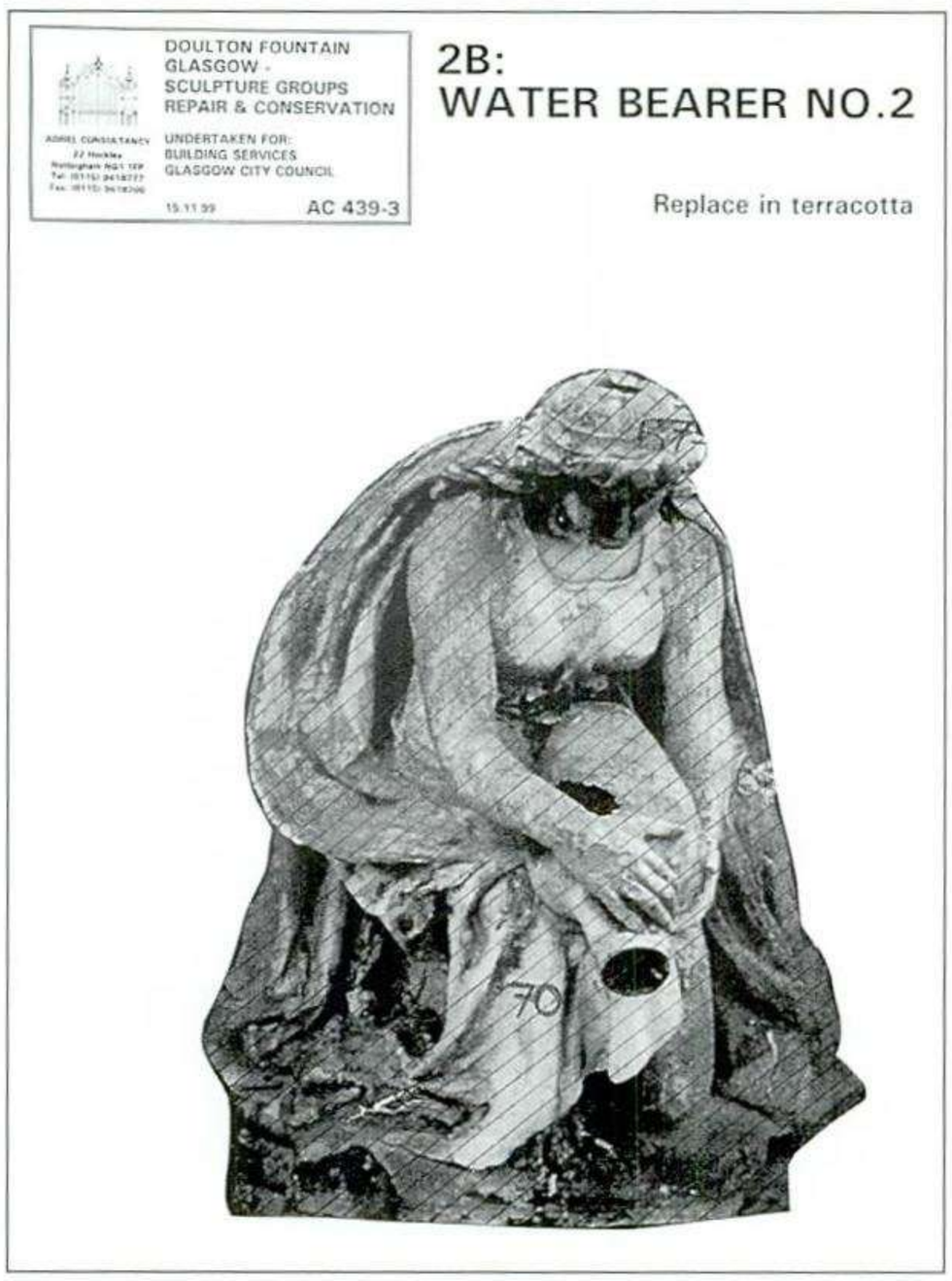
The Ostrich:

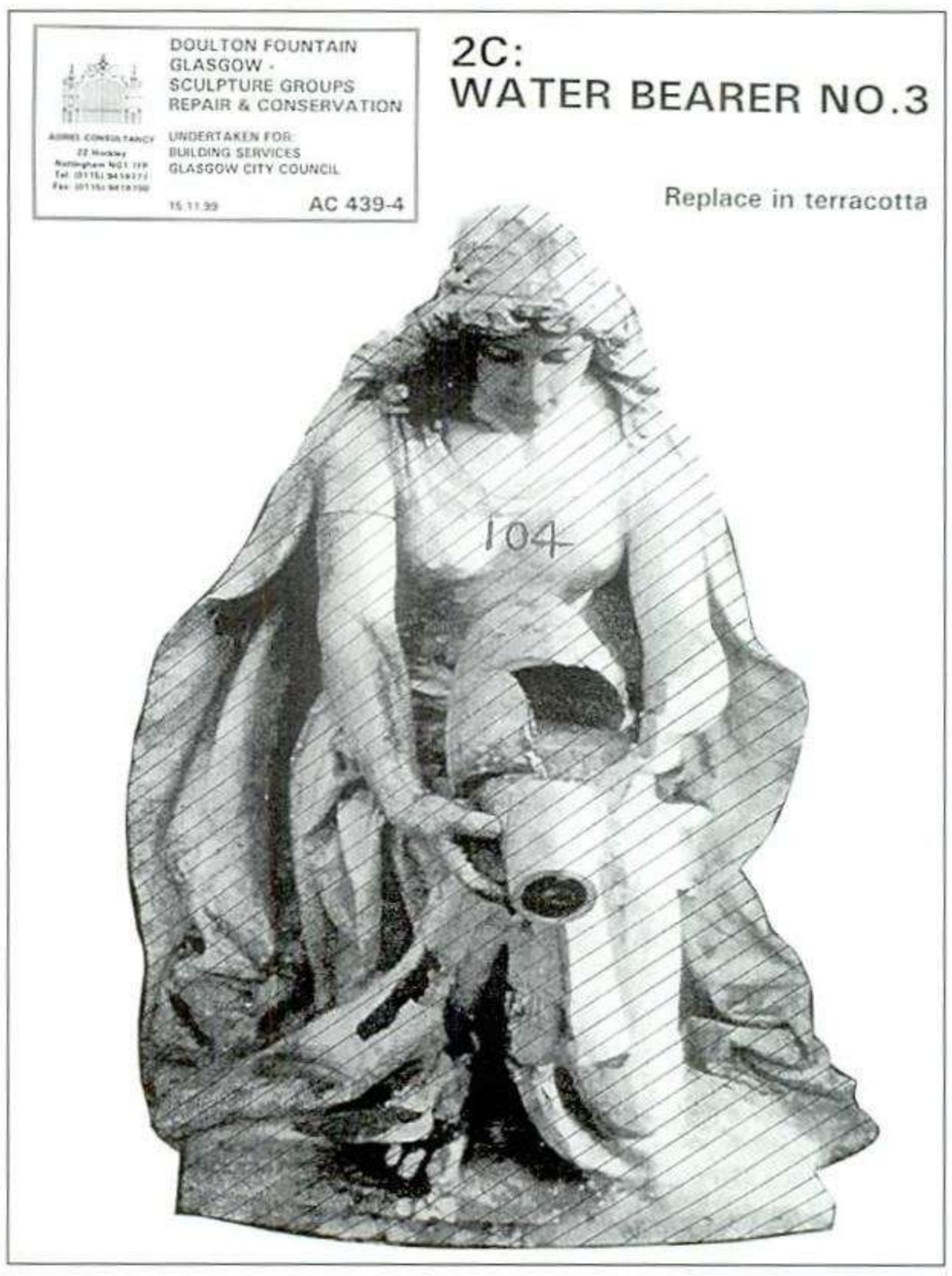
- This was completely missing and required replacement based on archival records alone, along with the front section of plumage. The ostrich's body and rear portion of plumage remained and could be retained with minor localised repairs.

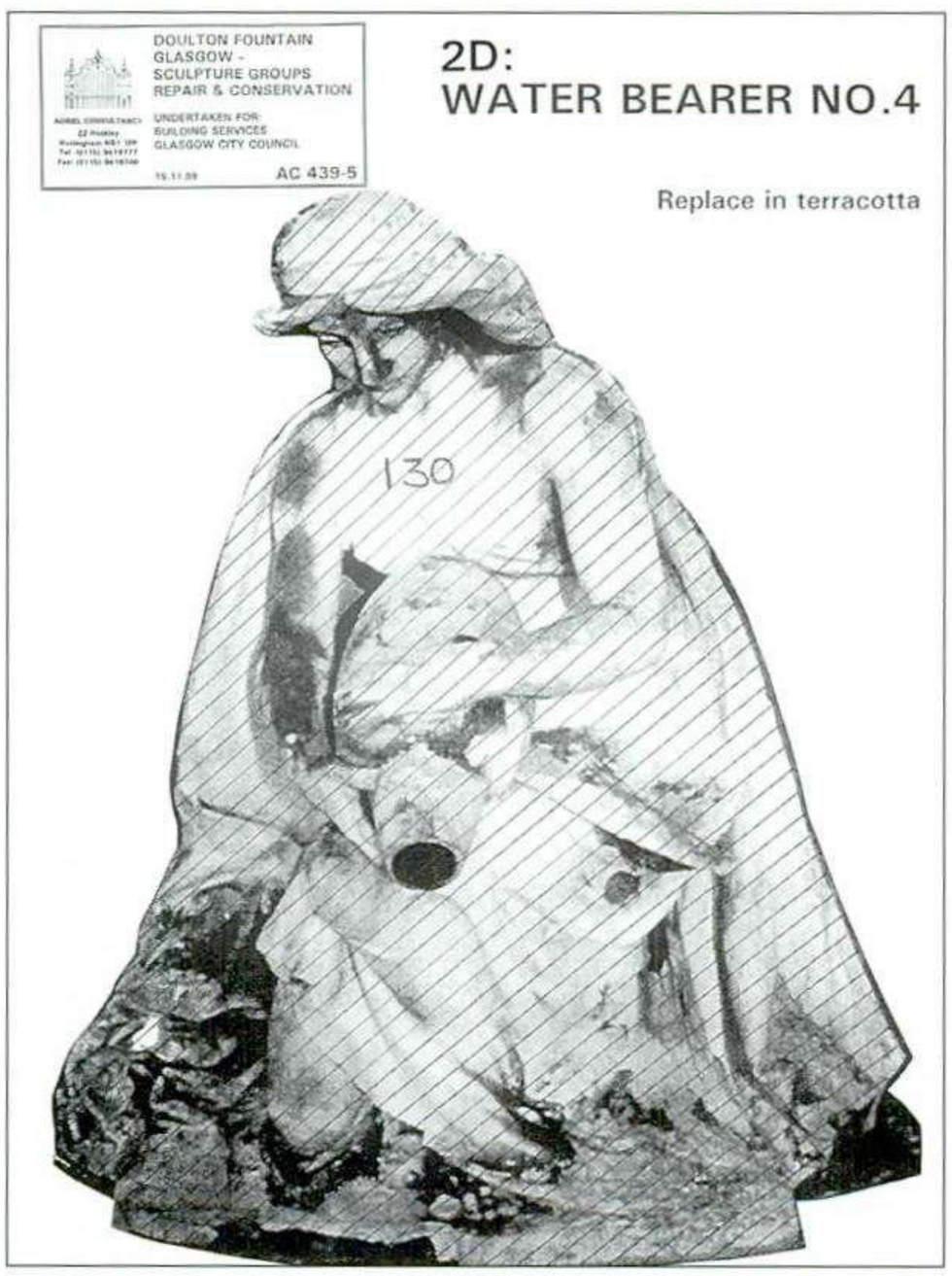
The Conservation Strategy for each sculpture is shown in the illustrations on the following pages.

Conservation Strategy for Queen Victoria. All her pieces could be retained. Only minor, localised repairs to areas of frost damage were necessary. (Adriel Consultancy)









Conservation Strategies for the four Water Bearers. Their extremely poor condition meant they needed to be replaced. *(Adriel Consultancy)*

DOULTON FOUNTAIN
GLASGOW -
SCULPTURE GROUPS
REPAIR & CONSERVATION

ADRIEL CONSULTANCY
22 Hockley
Nottingham NG1 1FF
Tel: (0115) 9418777
Fax: (0115) 9418700

UNDERTAKEN FOR:
BUILDING SERVICES
GLASGOW CITY COUNCIL

15.11.99 AC 439-6

3A: ROYAL IRISH FUSILIER

HEAD:
Replace in terracotta.

TORSO:
Repair original.

Small replacement pieces (in terracotta):
- bayonet.
- 2 No. sections of gun barrel and butt.
- details to epaulettes.

LEGS AND BASE:
Repair original.
Replace missing corner in terracotta.

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UNDERTAKEN FOR:
BUILDING SERVICES
GLASGOW CITY COUNCIL

15.11.99 AC 439-7

3B: BLACK WATCH HIGHLANDER

HEAD:
Retain original - minor repairs.

TORSO:
Retain original - minor repairs.

Restore bayonet in terracotta.

LEGS AND BASE:
Retain original - minor repairs.

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UNDERTAKEN FOR:
BUILDING SERVICES
GLASGOW CITY COUNCIL

15.11.99 AC 439-8

3C: GRENADIER GUARDSMAN

HEAD AND TORSO:
Reconstruct from original pieces.

Replicate missing details from existing documentary evidence.

Restore bayonet.

LEGS, BASE AND GUN:
Retain original.
Reconstruct fractured pieces to tops of legs.

Rejoin sections of gun.

Repair missing section to rear of base.

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UNDERTAKEN FOR:
BUILDING SERVICES
GLASGOW CITY COUNCIL

15.11.99 AC 439-9

3D: SAILOR

HEAD:
Replace in terracotta.

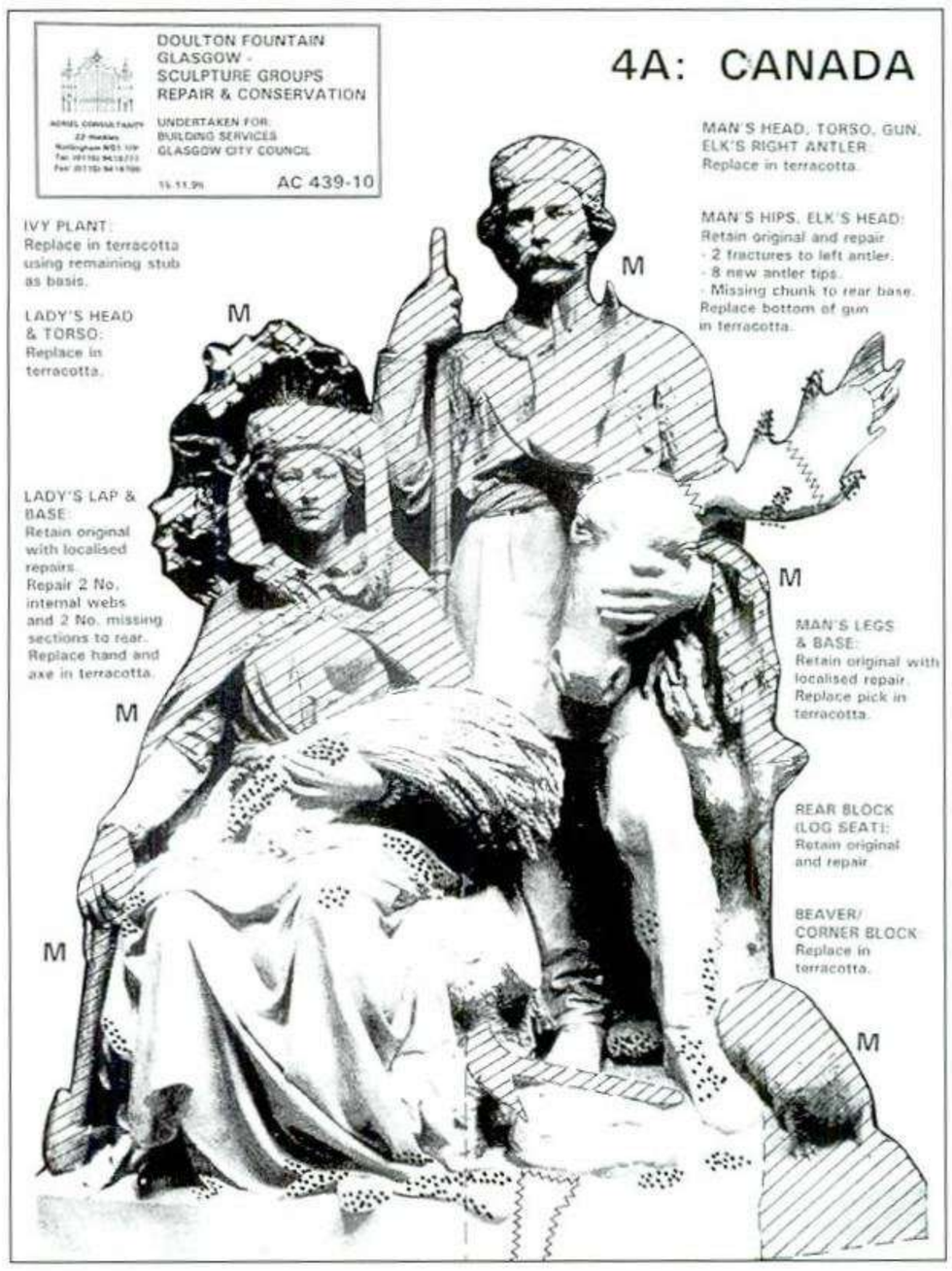
TORSO:
Retain original with minor repairs.

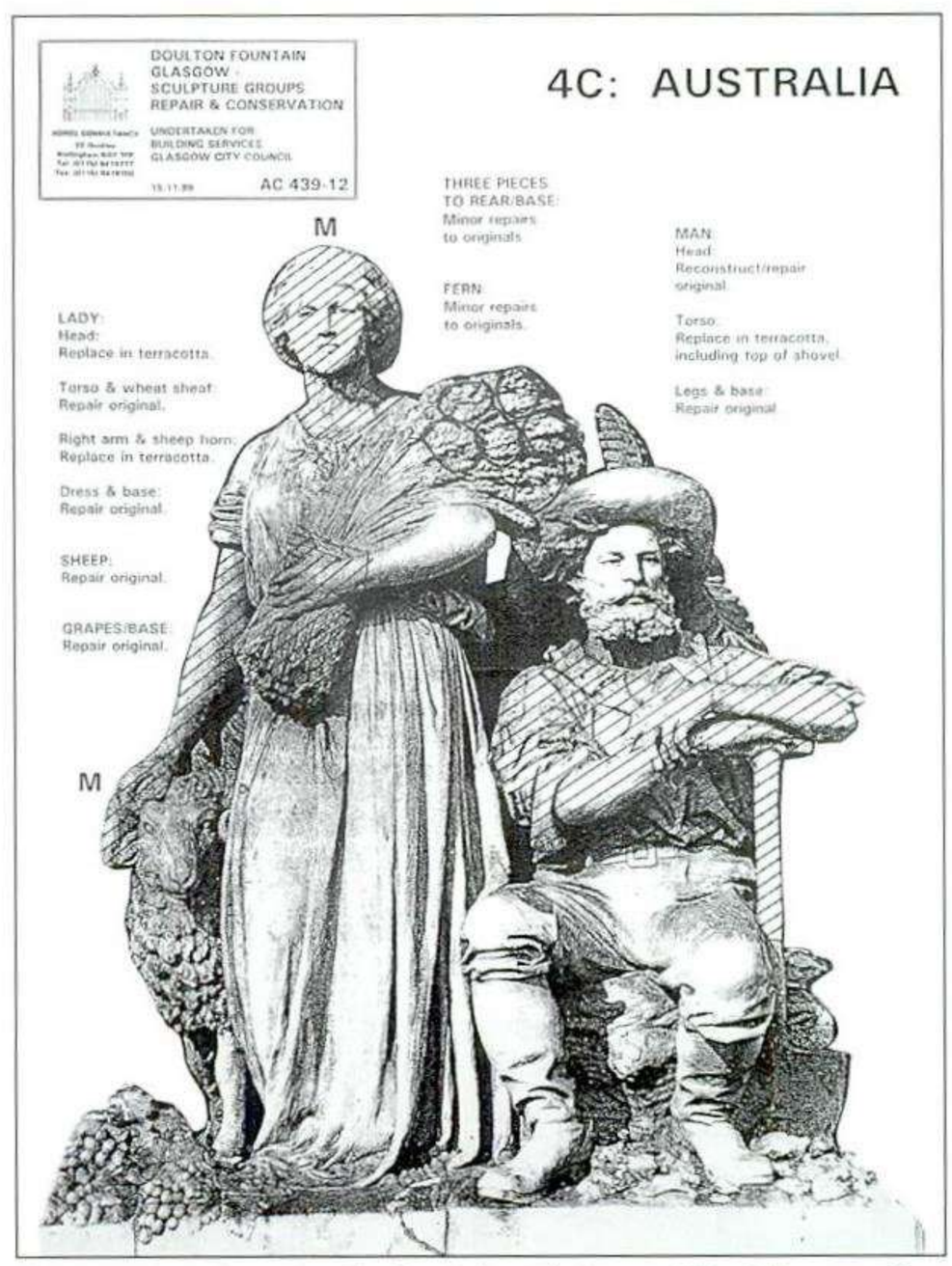
Replace missing detail:
- rope to front of shirt.
- tassle/tie to bottom of shirt.

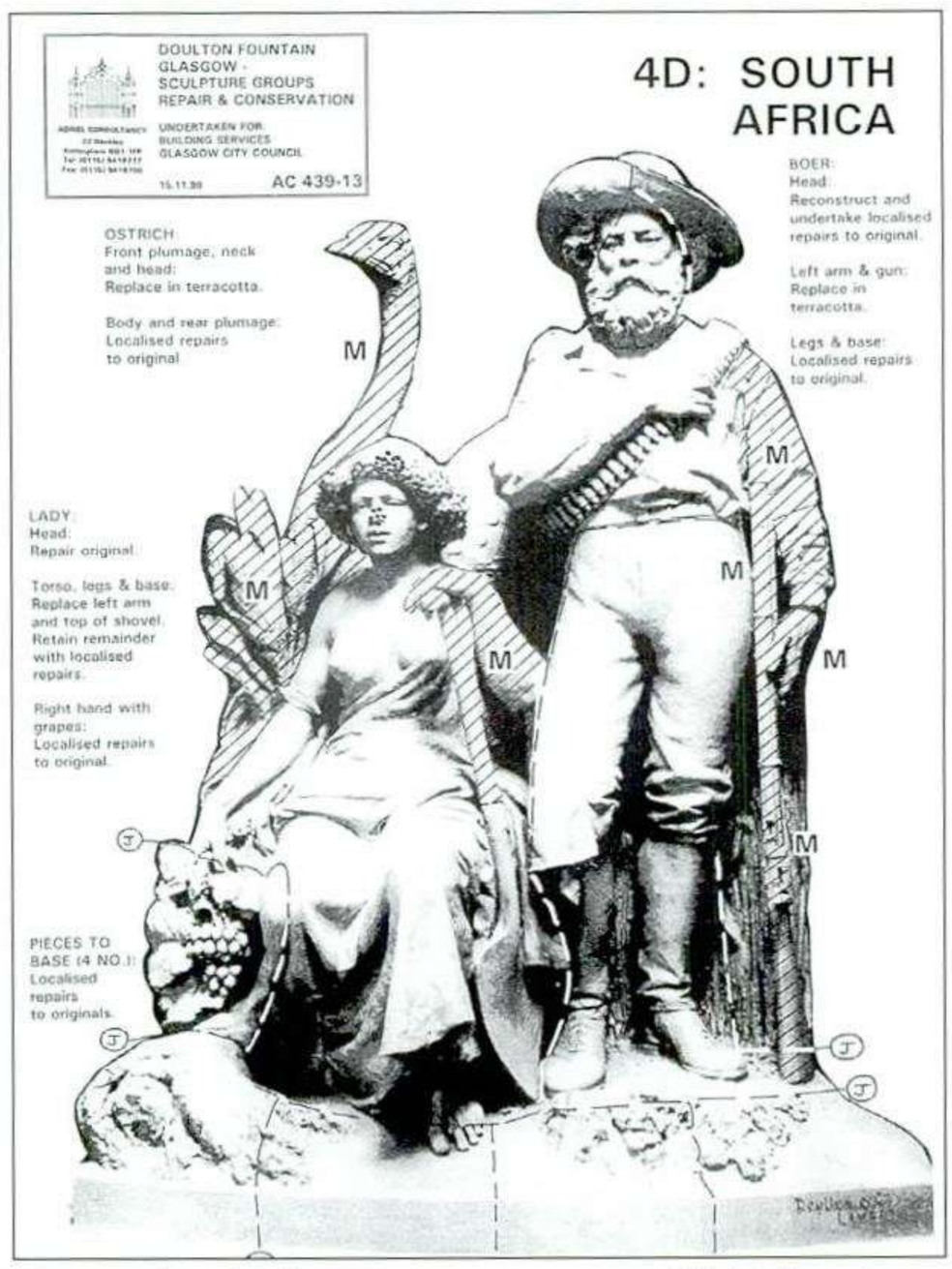
LEGS, BASE AND GUN:
Retain original with minor repairs.

Replace top of gun in terracotta.

Conservation Strategies for the Military Figures. Most repair works related to missing or vandallised parts. *(Adriel Consultancy)*







Conservation Strategies for the Colonial Groups. The full scope of conservation, repair and replacement techniques were required on the pieces of these large, complex assemblies. *(Adriel Consultancy)*

3.2.3 Management Structure of the Project Team

The set up of the project team evolved out of the process of tendering the schedule of repairs and replacements for the blocks of the fountain structure, as well as the process of approving samples of workmanship for the sculptures.

The team management structure which was set up for the pre-construction phase provided direct links between the main parties, and is shown in the illustration below. Due to the success of this stage it was used during the construction phase as well.

3.3 Executing the Conservation Strategy

The sculptures of the Doulton Fountain were made up of several pieces. Some needed repair, some complete replacement and some replacement of part of a piece.It was therefore necessary to arrange the contract for the works so that:

- The repair and conservation works were undertaken by a Sculpture Conservator experienced in terracotta sculpture.
- The Sculpture Conservator had a workshop within the terracotta manufacturer's premises, to allow very close interface between the Conservator and the Manufacturer regarding replacement of whole pieces and parts of pieces.
- The Terracotta Manufacturer's staff included a modeller capable of replication of pieces and parts of pieces, in the style of the original work, not an imposed style.

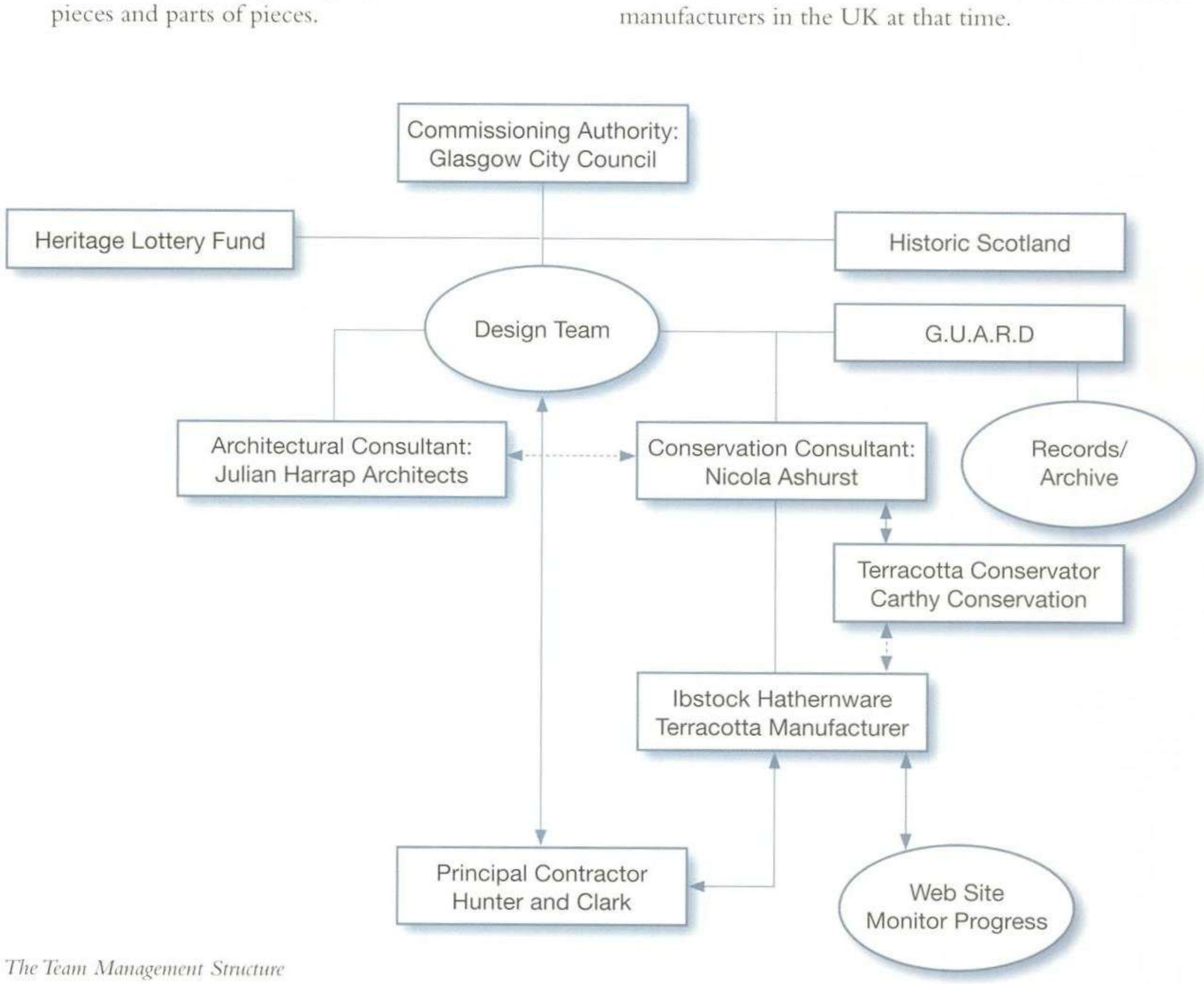
3.4 Selection of the Terracotta Manufacturer

3.4.1 Establishing Costs & Programme

The tendering of the work on the fountain blocks determined the cost of the units, as well as the length of time that was going to be required for the necessary surveying, pattern making, mould making, block making, drying and firing processes. It became clear at this early stage that a long lead-in time would be involved for the terracotta and that the Glasgow City Council would need to place an advanced contract for its purchase.

The samples and tendering period also determined that the programme for the replacement of the terracotta sculptures was going to be at least six months longer than the main contract. to rebuild the fountain. The contract for these works as well would need to be let by GCC in advance of the contract to rebuild the fountain. The main contractors consulted at this time indicated a strong preference for the contract for the terracotta to be let by GCC rather than themselves.

The work was offered for tender to the two terracotta manufacturers in the UK at that time.



The Team Management Structure

3.4.2 Key Dates

Hunter & Clark was appointed Principal Contractor on 16th September 2002. Ibstock Hathernware was appointed teracotta manufacturer on 10th October, 2001.

The rebuilding of the fountain superstructure began in January 2004 and was completed 11 months later.

On 9 May, 2005 the fully restored water feature system was switched on again at the official opening of the restored fountain.

3.4.3 The Preparation of Samples of Replacement Sculpture

The two UK based terracotta manufacturers were asked to replicate a piece from the sculptures, as a sample of materials and workmanship which could be assessed by the project team. Shaws of Darwen was required to make the male head from the Australia group. Ibstock Hathernware of Loughborough was given the head of the Boer from the South Africa group.

The Boer's head from the South African group: in pieces as found, reconstructed and the clay model of the successful sample piece. *(Nicola Ashurst)*

Bat's head and tracery: an early photograph of the piece intact, the approved clay sample and part of the model from which the mould *(Ibstock Hathernware)*

A process of meetings and samples led to the eventual selection of Ibstock Hathernware as the manufacturer for the replication of the missing sculpture pieces. Ultimately Ibstock Hathernware was also selected for the replacement terracotta blocks, giving the much needed benefit of consistency between the manufacture of both blocks and sculpture.

The samples process also established that it was fundamental that a direct link was maintained between Glasgow City Council, its terracotta consultant and the terracotta manufacturer. A best-practice evaluation also confirmed it would be best for the Council to have direct contact with the supplier of the terracotta so that the essential flexibility and quality of the works could be overseen directly. It was also decided that the best quality control on the terracotta manufacturing and during the construction phase would be obtained through a single consultant.

3.4.4 Ibstock Hathernware

Ibstock Hathernware Limited began life in 1874 as the Hathern Station Brick and Terracotta Company. Initially a brick manufacturer by 1900 it was manufacturing a wide variety of architectural terracotta. The buildings for which Hathernware produced the terracotta include the London Coliseum.

(Ibstock Hathernware)

The 1980's brought about growth and expansion to the virtually defunct terracotta industry of that time. Buildings constructed in the late Victorian period, and also in the early Edwardian period, began to show signs of damage often caused by the expansion of corroding steel structures and fixings Other factors such as the listing of buildings of architectural merit gave impetus to the concept of restoration.

In 1961 Hathernware merged with the Shaw's Glazed Brick Company, to be divorced in 1980. After that it traded as Hathern Ceramics Limited. In 1990 it was bought by Ibstock Brick Limited and traded as Ibstock Hathernware Limited until October 2004 when the parent company closed the business at the completion of the Doulton Fountain project.

3.5 Tendering of the Contract

Once the terracotta manufacturer was selected the contract for the whole of repair and replacement of the terracotta work was re-tendered to select a main contractor. Tenderers were advised of the proposed arrangement for the engagement of the terracotta manufacturer and the contract requirement that a conservator's workshop be established within the terracotta factory.

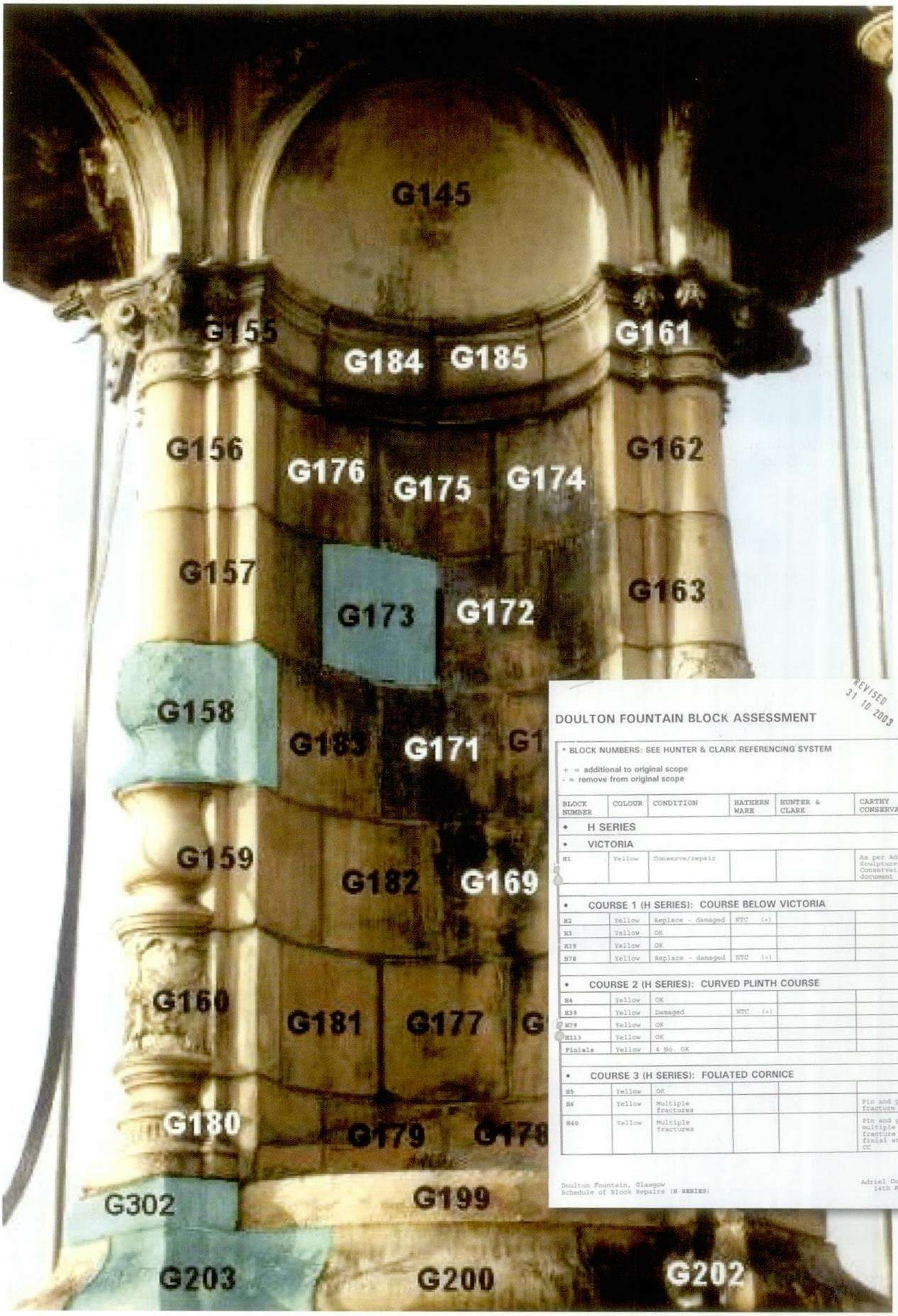
The contract made it clear of the value of the terracotta pieces and the processes that would be required to deal with them:

- All terracotta components were to be regarded as works of art.
- The existence of the survey work, archaeological reports, structural and architectural assessments was described.
- The roles of the archaeologist, terracotta consultant and the conservator were emphasised.
- The need for sufficient areas to layout blocks dismantled from the fountain so that these could be reassessed was described in detail.

On the 18 November 1998 contracts were completed for the Heritage Lottery Fund (HLF) Grant. On 13th November 2001 the HLF Grant was increased to a total of £8,821,000.00.

3.6 Selection of the Sculpture Conservator

After a tendering and assessment period of three conservators experienced in working on terracotta sculptures, undertaken on behalf of GCC by Adriel Consultancy, Carthy Conservation of London was selected. Carthy Conservation was a conservation firm which had worked throughout the UK and had established expertise in the repair of terracotta blocks and figures. They were also suited to locating to the terracotta manufacturers workshop for the duration of the sculpture repair contract. The contract for the conservation works was managed by Adriel Consultancy.



REVISED 31 10 2003

DOULTON FOUNTAIN BLOCK ASSESSMENT

* BLOCK NUMBERS: SEE HUNTER & CLARK REFERENCING SYSTEM

\+ = additional to original scope
\- = remove from original scope

BLOCK NUMBER	COLOUR	CONDITION	HATHERN WARE	HUNTER & CLARK	CARTHY CONSERVATION
• H SERIES					
• VICTORIA					
H1	Yellow	Conserve/repair			As per Adriel Sculpture Conservation document
• COURSE 1 (H SERIES): COURSE BELOW VICTORIA					
H2	Yellow	Replace - damaged	NTC (+)		
H3	Yellow	OK			
H39	Yellow	OK			
H78	Yellow	Replace - damaged	NTC (+)		
• COURSE 2 (H SERIES): CURVED PLINTH COURSE					
H4	Yellow	OK			
H38	Yellow	Damaged	NTC (+)		
H79	Yellow	OK			
H113	Yellow	OK			
Finials	Yellow	4 No. OK			
• COURSE 3 (H SERIES): FOLIATED CORNICE					
H5	Yellow	OK			
H6	Yellow	Multiple fractures			Pin and glue fracture CC (+)
H40	Yellow	Multiple fractures			Pin and glue multiple fracture to finial stooling CC (+)

Doulton Fountain, Glasgow
Schedule of Block Repairs (H SERIES)

Adriel Consultan
14th April 20

Examples of the recording systems used to identify blocks, record their colour and condition and to schedule repairs. (Hunter and Clark, Adriel Consultancy)

4 DOWNTAKING, REASSESSMENT AND CONDITIONS FOUND

4.1 Numbering and Downtaking of the Fountain

4.1.1 The Numbering System

During the dismantling process each block was identified to ensure that it would be rebuilt in the same location it had been removed from. The unique reference number of each block was marked twice on its unexposed sides. The numbering system was also recorded on digital photographs and drawings. The numbering system required modification during the downtaking phase as the configurations of blocks became apparent.

4.1.2 Recording the Downtaking

The downtaking of the fountain began in April 2003.

- Work began with the taking of dimensions and making all other records necessary for the identification of each block and the accurate rebuilding of the fountain.
- As each course was exposed it was sketched by the mason on site, overall and detailed dimensions also being taken. This information was used as a record of the fountain to ensure accurate rebuilding and to prepare accurate record drawings of the fountain and the necessary construction drawings required for rebuilding.
- Photographs were also taken on a continuing basis to record the character of the original terracotta in particular joint widths, joint taper, original plumbness and original out of line.

The removal and packaging of one of the Water Bearers. *(Glasgow City Council)*

(Glasgow City Council)

Queen Victoria is lowered and packaged before crating and her journey to the conservator's workshop. *(Glasgow City Council)*

4.1.3 Sequence and Ease of Work

The outer wall to the lower basin and the first level of terracotta up to the bases of the colonial statues were taken down first to provide access for the internal scaffolding surrounding the main structure of the fountain. This downtaking was relatively easy as only minimal block filling had been carried out and many of the areas had been loosened by heavy weathering. Thereafter dismantling started at the top of the fountain working course by course down to the arched niches housing the colonial figures.

The base of Queen Victoria had been filled with a hard concrete with a central pin set in more concrete which extended down into the main shaft. Once the pin was located and exposed, it was cut and Queen Victoria was safely removed, taken to the ground, boxed and taken to the conservator's workshops.

Throughout the works small hand held tools were used and every effort was made to reduce damage to sound blocks. The terracotta of the Doulton Fountain was very closely jointed making this a particularly demanding exercise when combined with the very brittle nature of the material and the strength of its bedding mortar. Blocks which needed to be destroyed to obtain access to the removal of others were chosen carefully, usually being those which were already weathered or damaged and scheduled for replacement.

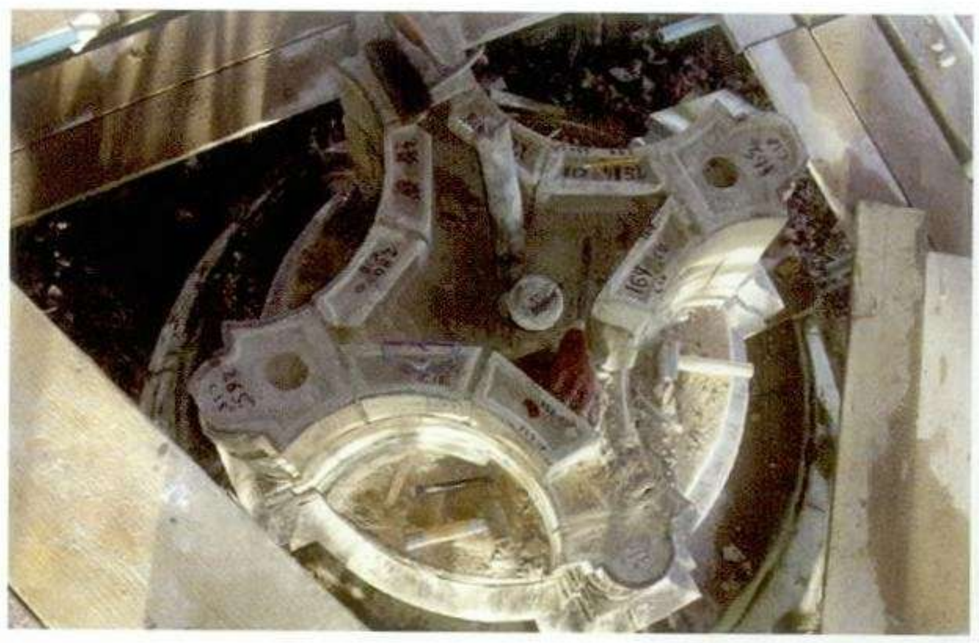
It had been assumed that the terracotta blocks of the main superstructure were built around a brick core. In actual fact the core consisted of a fairly dense concrete with broken brick aggregate which was extremely difficult to remove. This not only delayed the progress of the downtaking but also resulted in a small number of blocks being necessarily destroyed requiring additional replacement blocks to be manufactured. The additional replacement blocks had in part been anticipated so the additional work was absorbed into the programme relatively easily.

The terracotta and core were carefully taken down course by course until the main dome was exposed. The dome was then supported on a timber frame to permit the down taking process and recording to proceed. The main cantilevered basin and the remaining terracotta surrounding the iron frame of the base of the basin and its columns were then removed.

Of the total blocks that made up the fountain superstructure just over fifty five percent were initially scheduled for replacement. The final total was increased by three percent by the downtaking.

The terracotta blocks were taken down by experienced stone masons using hand held tools. *(Nicola Ashurst)*

(Glagow City Council)



(Glagow City Council)

The unique reference number of each block was marked on internal faces.
The downtaking process involved the careful of original plumbing and reinforcing.

(Nicola Ashurst)

The cast iron and wrought iron frame of the cantilevered basin, exposed and prior to dismantling. *(Nicola Ashurst)*

4.1.4 Downtaking the Iron Frame

The cast iron and wrought iron frame to the cantilevered basin and the colonial group piers was taken down with all pieces being salvaged. Most of the bolt and nut fixings were too corroded for salvage and were sacrificed in lieu of retention of the larger members.

4.2 First Re-Survey

Each block was inspected as it was removed from the fountain and the Schedule of Repairs revised. The schedule identified:

- What the condition of each block was and hence whether it could be retained or needed to be replaced or repaired.
- The colour of each block was recorded, to enable the colours of replacement units to reflect the original colours of each part of the fountain.
- The nature of any repairs, along with who should do the repairs (the Main Contractor or the Conservator).
- Any changes in block numbers that were necessary as downtaking confirmed the jointing pattern between units.

The process of downtaking, inspection and rescheduling took 8 weeks. Ibstock Hathernware adopted the role of keeping the Schedule of Works in electronic format.

The downtaking process revealed, as anticipated, that the true condition of the blocks was often different to the scope determined prior to dismantling. The true effect of weathering and the presence of major fracturing could only be appreciated after close range inspection of the removed units.

Even at this stage it was not possible to identify the fine fractures which were masked by soiling. It was therefore necessary to clean the blocks. This revealed previously unseen hairline fractures, typical of terracotta. Cleaning was also considered necessary as the conservation approach adopted for the sculptures meant that, where damaged, whole figures or whole pieces were not being replaced in full, only the damaged parts.

4.3 Cleaning Trials & Cleaning Works

A range of terracotta blocks was selected which were representative of the colours, surface profiles, terracotta conditions, and the soiling types, on the fountain. Blocks which would need cleaning ranged from plain to highly decorative, from smooth and hard to irregular and soft.

These parameters meant that the effectiveness of detergent and chemical cleaners was evaluated first. Abrasive cleaning procedures were not considered in the first instance due to terracotta's high intolerance of impact of any kind. Water-based methods would not be effective as the soiling was not water-soluble.




Downtaken blocks on palettes in the site compound, created ready for transportation and stored at the factory after new ones had been made. *(Glagow City Council)*

The following cleaning agents were evaluated:

- Masonry detergent and hot water washing.
- Alkaline gel followed by acetic acid neutraliser.
- Alkaline gel followed by hydrofluoric acid (HF) gel neutralisers (0.7% HF and 5% H.F).
- Hydrofluoric acid gel cleaners alone (0.7% HF and 5% HF).
- Ethylenediaminetetracetic acid (EDTA) – based clay poultice.
- Alkali - based clay poultice.

The trials led to the selection of the hydrofluoric acid gel cleaner (5% HF), used at a range of dwell times of up to 5 minutes, depending on the degree and tenacity of the soiling. The selected process also included very thorough prewetting and rinsing procedures. All other products were only partially effective.

As part of the cleaning trials process, a rig was developed to collect all the effluent created by the cleaning processes. This was used throughout the cleaning of all the blocks.

The terracotta of the Doulton Fountain had been cleaned before and it is possible that the sculptures were cleaned more than once. This was confirmed by indelible streaks and runs which remained on the surfaces of many of the blocks. These marks could not be removed by the relatively gentle cleaning regime of the current restoration. When the blocks were cleaned, whenever possible, these were oriented so that the latest cleaning was undertaken at a different orientation to previous regimes. Even application and agitation of the selected cleaner was undertaken to prevent any further streaking.

4.4 Second Re-Survey

The blocks which had been scheduled for retention or repair were cleaned and inspected once more. This revealed further micro cracking and the amount of repair and replacement increased slightly. The simpler repairs were allocated to the main contractor. The more complex were allocated to the Sculpture Conservator.

The blocks scheduled for repair by Hunter & Clark were repaired in accordance with the specification prepared by Julian Harrap Architects.

The condition of approximately 10% of the blocks referred to the Conservator was found to be too poor for successful repair and these needed to be replaced.

4.5 Storage of the Downtaken Blocks

It had not been considered feasible to store the components of the downtaken fountain on Glasgow Green for reuse due to the risks associated with the exposed location and the many events taking place on the Green. This was resolved by the erection of a large shed. Perimeter shelving enabled the blocks to be stored on pallets. This shed and its site compound proved invaluable for the temporary storage of blocks and sculptures before they were reinstalled.

(Nicola Ashurst)

(Nicola Ashurst)

(Nicola Ashurst)

Decorative blocks were cleaned by the conservator. Less decorative, simpler blocks were cleaned by the main contractor and kept in racks inside the site store until required during the rebuilding process.

The delicate process off removing the water bearers sculptures began with stabilisation of delicate surfaces. *(Nicola Ashurst)*

5 CONSERVATION AND REPAIR OF THE BLOCKS AND STATUARY

5.1 Consolidation of the Water Bearers

In June 2002 the fragile surfaces of the Water Bearers were consolidated and stabilised in situ by the Conservators.

The pieces were photographed after which layers of eltoline tissue and tape were used to hold detached detail in place. The Water Bearers were then released from the fountain, crated and transported to the Conservator's workshop.

During these works both the extremely poor condition of the water bearers and their extremely high art historical value, became more obvious.

5.2 Transport of the Sculpture Pieces

The sculpture pieces were packed by the Terracotta Manufacturer because of their experience in packing and transporting large fragile items. The Archaeologists prepared an inventory of all pieces that left Glasgow. The pieces were then transported to Ibstock Hathernware's factory at Loughborough where the Conservator was based.

While many boxes contained the larger pieces of the sculptures, there were several buckets which contained small fragmentary pieces, not all of which could be readily identified. It was acknowledged that the physical evidence provided by the original sculpture pieces, no matter how small, was superior to documentary evidence and many hours were spent searching through these pieces. Part of the conservator's brief was to be involved in a process of identifying and locating the smaller pieces.

5.3 Repair of the Blocks on Site

Blocks repaired by the specialist masonry contractor on site were those which had simple fractures. The pieces were reattached by 4mm threaded stainless steel pins.

Queen Victoria, padded and crated, is secured on the lorry ready for her journey to the sculpture conservator's workshop. *(Glasgow City Council)*

5.4 Conservation and Repair of Blocks by the Conservator

In addition to the work on the sculptures the skills of the conservator were considered necessary for approximately 100 blocks which were either in borderline condition or had complex fracturing and detachment of details. Each of these blocks was first cleaned by the conservator and then its future assessed in collaboration with the Terracotta Consultant.

The blocks dealt with in this way were those at the interface between those which clearly required replacement and those which could sensibly be repaired.

Effort was also made to see if at least one of each type of original block could be rebuilt back in the fountain.

5.5 Sculpture Cleaning

5.5.1 The Reasons for Cleaning

Cleaning of the sculptures was needed to reveal small scale defects and to provide a satisfactory visual context within which localised repair or replacement works such as missing fingers and noses could be made.

5.5.2 Initial Washdown

The pieces of sculpture were first washed down with low pressure water to remove loosely adherent soiling such as bird guano and algal growth. They were then closely inspected.

5.5.3 The Cleaning Trials on the Sculptures

Cleaning trials were undertaken utilising a series of low strength chemical ingredients. Due to the detail, convoluted and textured surfaces of the sculptures and the obvious variations in their surface colouring, it was decided to fully investigate this method of cleaning first. It was established that a purpose made cleaning gel based on low strength hydrofluoric acid (less than 5%) which was formulated specifically for the sculptures was the most successful.

The cleaning process that was eventually adopted was as follows:

i) The sculpture pieces were thoroughly pre wetted. Then the gel applied for a dwell time of up to 10 minutes and agitated with soft brushes.

ii) This was followed by a rinse regime of approximately 15 minutes.

iii) At the end of the rinse programme the surfaces were tested at least 3 times to confirm that they had returned to a neutral pH status and that therefore all chemical was removed. Throughout the drying out period of the following two days the surface pH testing continued.

iv) Further rinsing was undertaken where necessary, to return surfaces to neutral pH.

Queen Victoria's head after cleaning. *(Nicola Ashurst)*

(Nicola Ashurst)

Details of Queen Victoria's dress, after cleaning. *(Nicola Ashurst)*

(Nicola Ashurst)

5.6 Post-Cleaning Inspection of the Sculptures

As pieces were cleaned and re-inspected by the terracotta consultant and the sculpture conservator, the scope of repairs was finalised.

The cleaning revealed many more fine fractures and surface spalls which had not been apparent up to that point. Importantly, it also enabled variations of surface colouring of the sculptures to be seen. These needed to be accurately matched during the repair processes.

5.7 Sculpture Repairs

The conservators used the following repair processes:

5.7.1 Reattachment of pieces.

This work was necessary to repair vandal damage. Pieces which were reattached had small stainless steel threaded dowels inserted along their fracture lines, embedded in epoxy resin, before the pieces were re-adhered using a colour matched mortar.

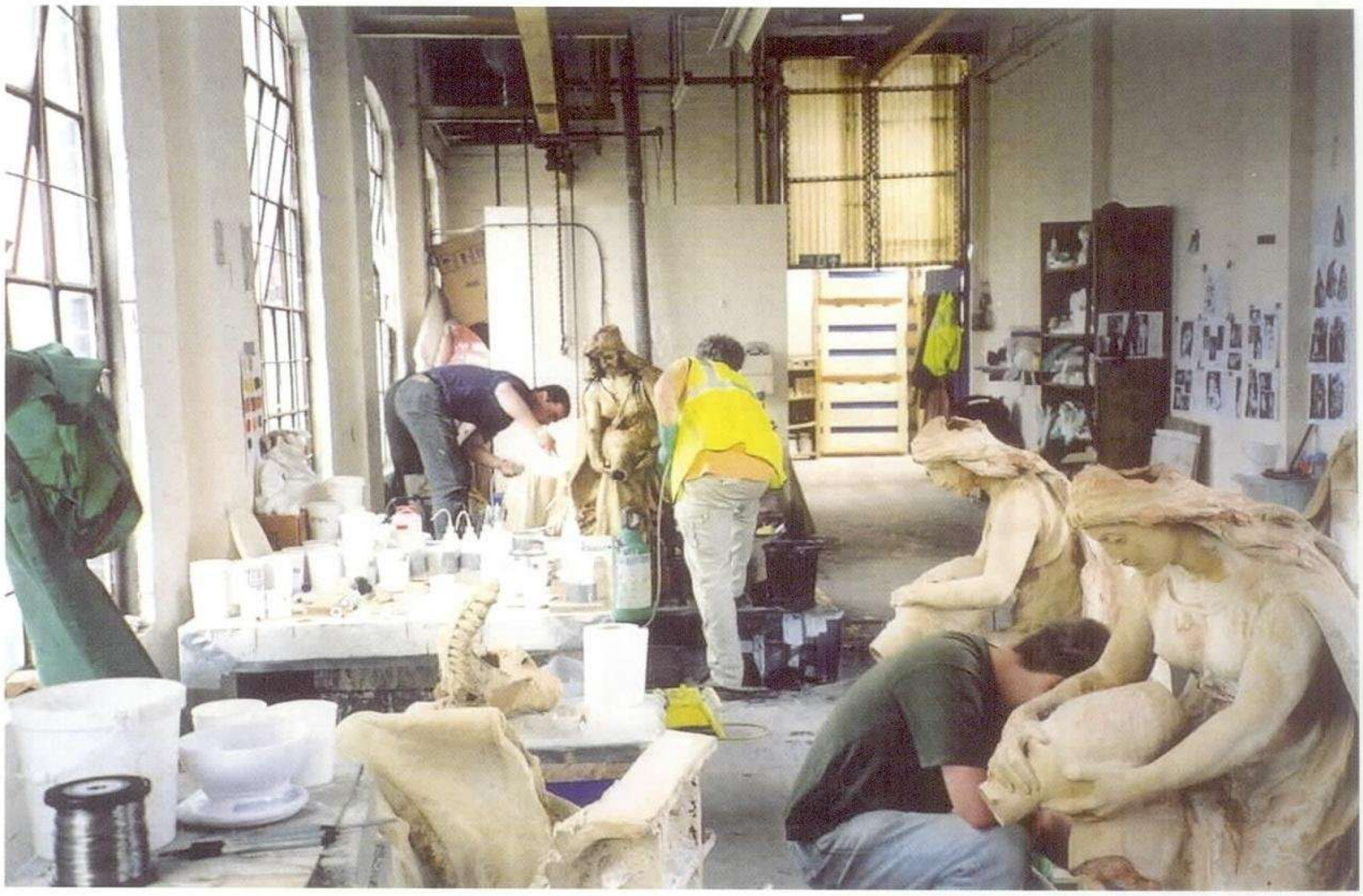
5.7.2 Reattachment of surface flakes.

This work was undertaken only on the Water Bearers which were not to be returned to an external environment. Dislodged flakes of terracotta were reattached using miniature dowels and polyester resin.

5.7.3 Localised mortar repairs.

These were undertaken to make good significant losses of important detail caused by heavy weathering or vandal damage, such as missing noses, fingers and bullet ends. They were also used to make good deep weathering losses that frost would continue to explore causing ongoing damage of an otherwise sound piece of sculpture. Their use was limited to the absolute minimum because of their limited life span in the context of a working fountain.

The mortar repairs were undertaken using "Lithos Arte" mortar manufactured by Arte Mundit of Belgium. Derived from a C19 French recipe, this mortar is based on a very stable form of zinc oxide, calcium carbonate, aggregates and natural pigments. Mortar repairs on terracotta using both lime-based and cement-based mortars do not perform well. Evidence of fifteen year old Lithos Arte repairs in brick and terracotta substrates in Belgium indicated this mortar had a better performance. The repair mortar was also selected because of its versatile suitability for the repair of profiled and heavily ornamented works in statues and the variable and stable colour matching that could be achieved with it. Importantly its finished surfaces could be carved or moulded to sit perfectly within the context of the many variations of the fountain pieces. It also provided an excellent colour and texture match to the terracotta when the surfaces were either wet or dry.



(Nicola Ashurst)

In the conservator's workshop, the Water Bearers are cleaned and conserved. *(Nicola Ashurst)*

5.8 Record of Work by the Sculpture Conservator

Part of the Conservators' work regime included the detailed recording of all repairs undertaken to all sculpture pieces. Drawings and notes on these were collated in a report. (*Carthy Conservation & Adriel Consultancy, 2005*).

Examples of the records are shown on the following pages.

KEY FOR REPAIR CODES:

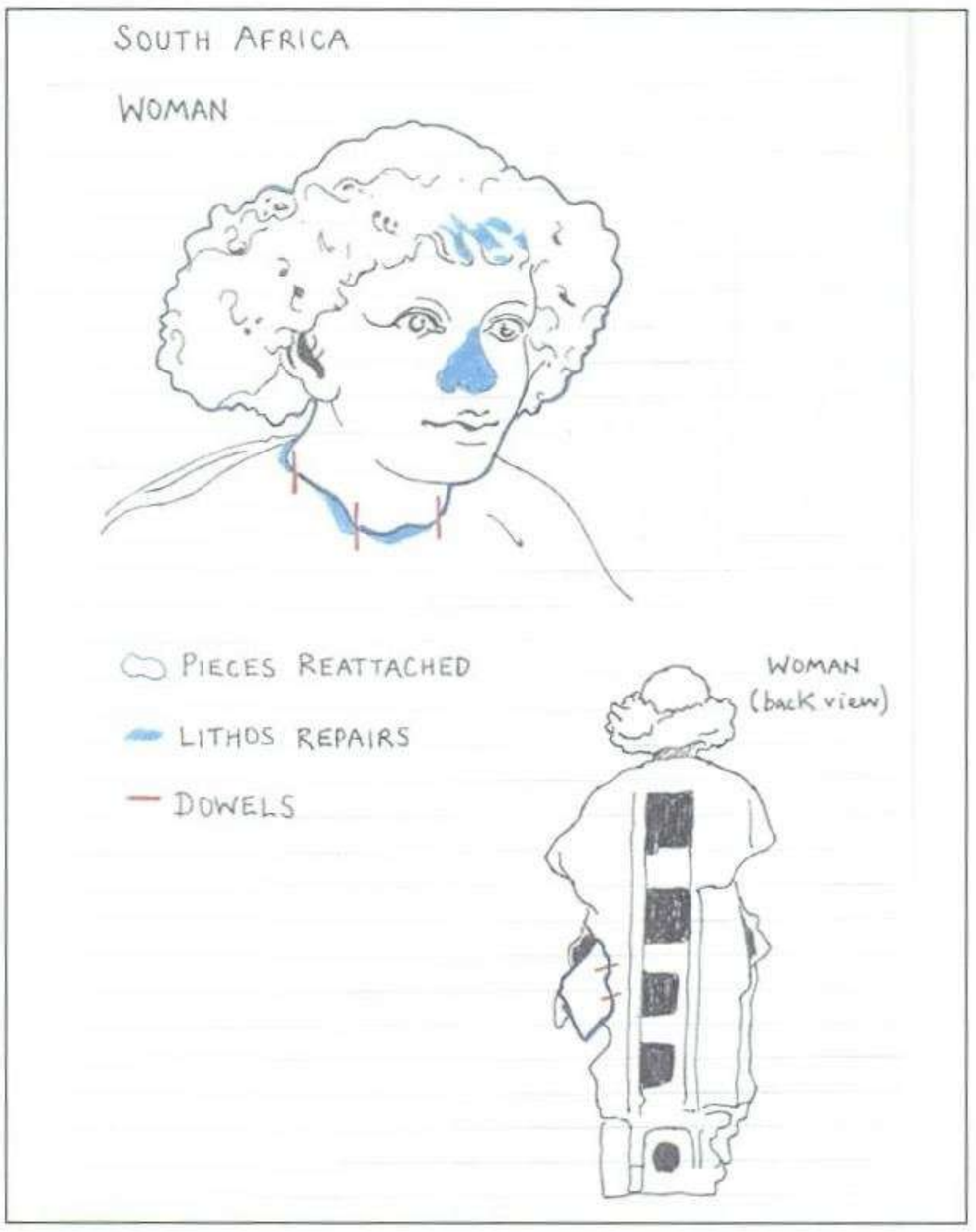
PIECES REATTACHED – refers to consolidation of semi-detached small pieces or whole loose fragments rejoined to main body with resin

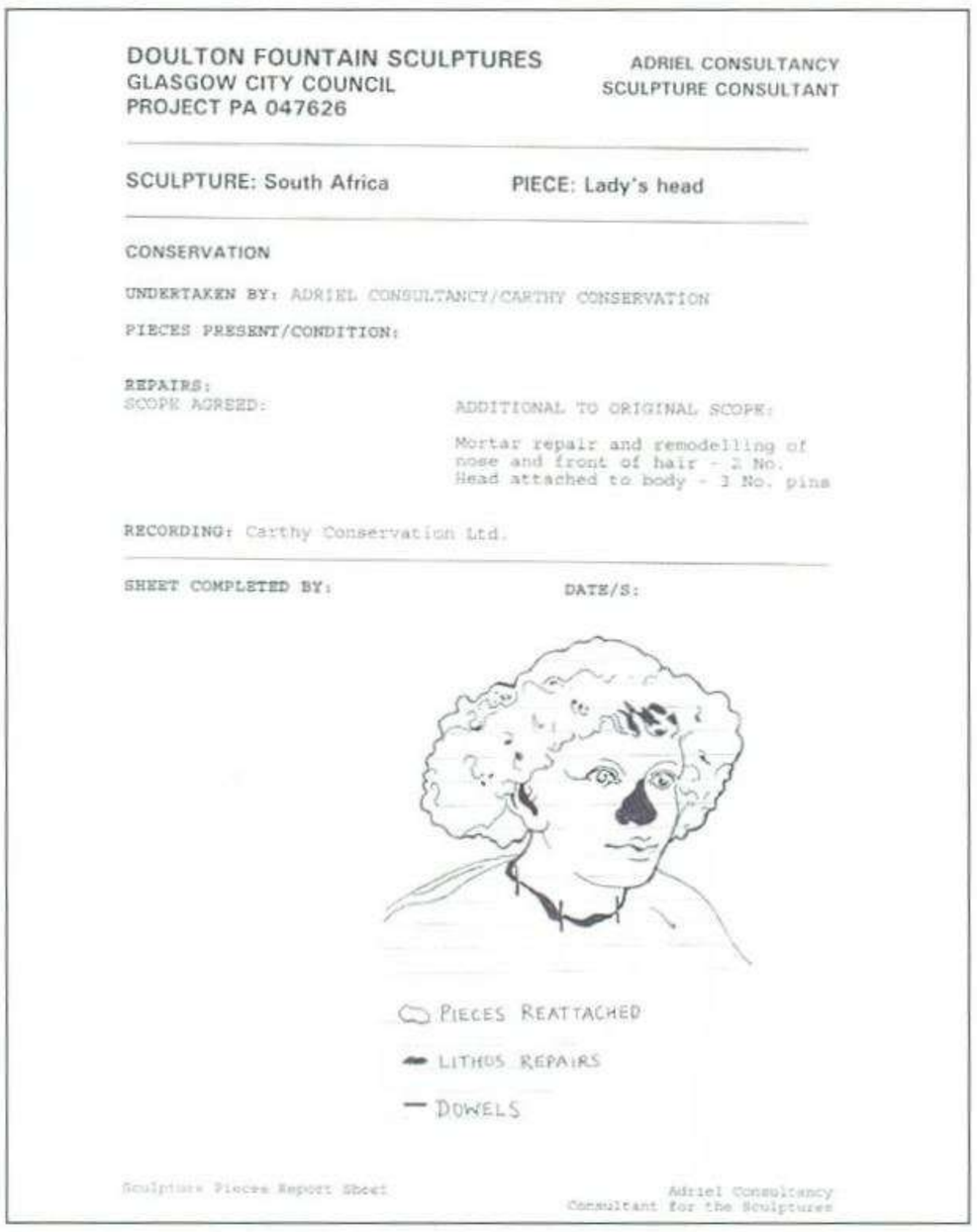
DOWELS - inserted into holes drilled on opposing faces of fragments and main body, to support substantial detached pieces

PINS - lighter dowels used to reinforce cracked areas or support small reattached pieces

RESIN FED INTO CRACKS - usually combined with pinning to strengthen small reattached pieces and cracked areas

LITHOS REPAIRS – Mortar repairs using "Lithos" repair Mortars involves keying surface in shallow areas or in deeper regions the attachment of an armature prior to application of Lithos





Record of conservator's works to the head of the South African woman.
Her head was reattached and minor reapirs undertaken to her forelock and nose.

(Carthy Conservation)

DOULTON FOUNTAIN SCULPTURES
GLASGOW CITY COUNCIL
PROJECT PA 047626

ADRIEL CONSULTANCY
SCULPTURE CONSULTANT

SCULPTURE: South Africa **PIECE: Male torso**

CONSERVATION

UNDERTAKEN BY: ADRIEL CONSULTANCY/CARTHY CONSERVATION

PIECES PRESENT/CONDITION:

REPAIRS:
SCOPE AGREED:

ADDITIONAL TO ORIGINAL SCOPE:

Removal of fragment of left arm from shoulder socket and reducing internal cement bulk.
Replacement of 1 No. entire bullet, 7 No. cartridge ends and 17 No. bullet ends.

RECORDING: Carthy Conservation Ltd.

SHEET COMPLETED BY: **DATE/S:**

MAN'S TORSO
(front)

(back)

LITHOS REPAIRS

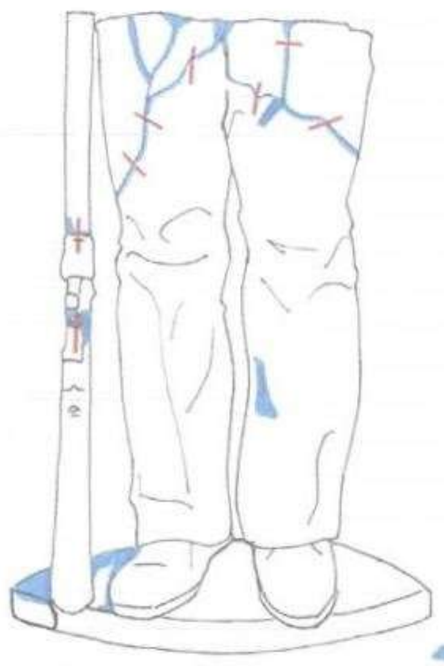
(Carthy Conservation)

(Carthy Conservation)

Record of the conservator's works to the torso of the South Africa man, before attachment of a new terracotta head.

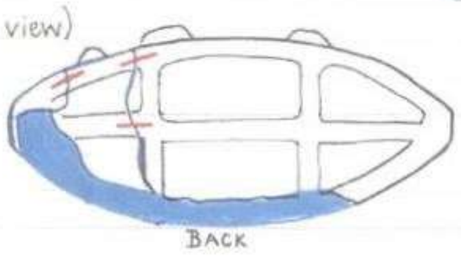
IRISH FUSILIER

LEGS AND BASE



LITHOS REPAIR
DOWELS
PIECES REATTACHED

BASE
(underneath view)

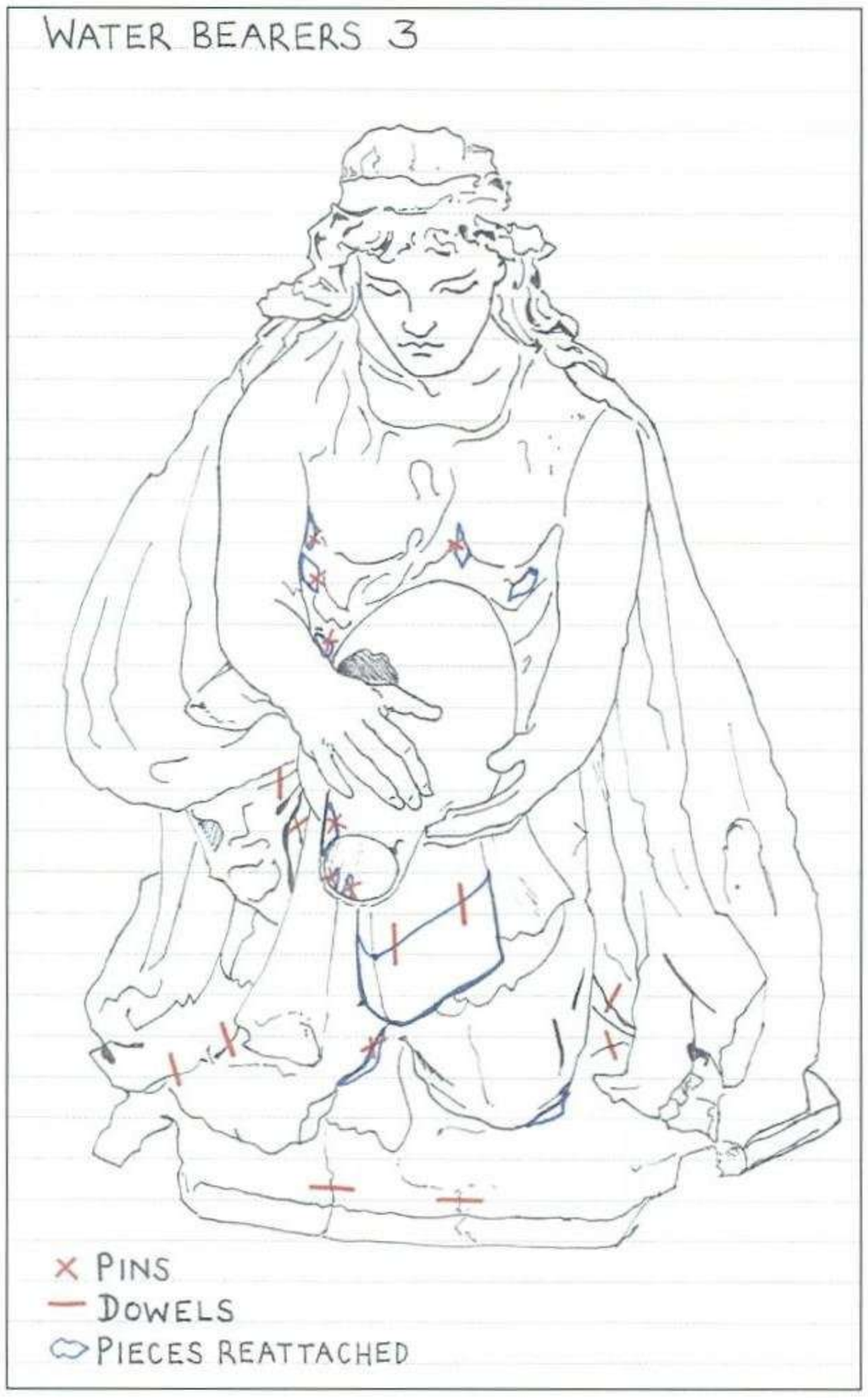


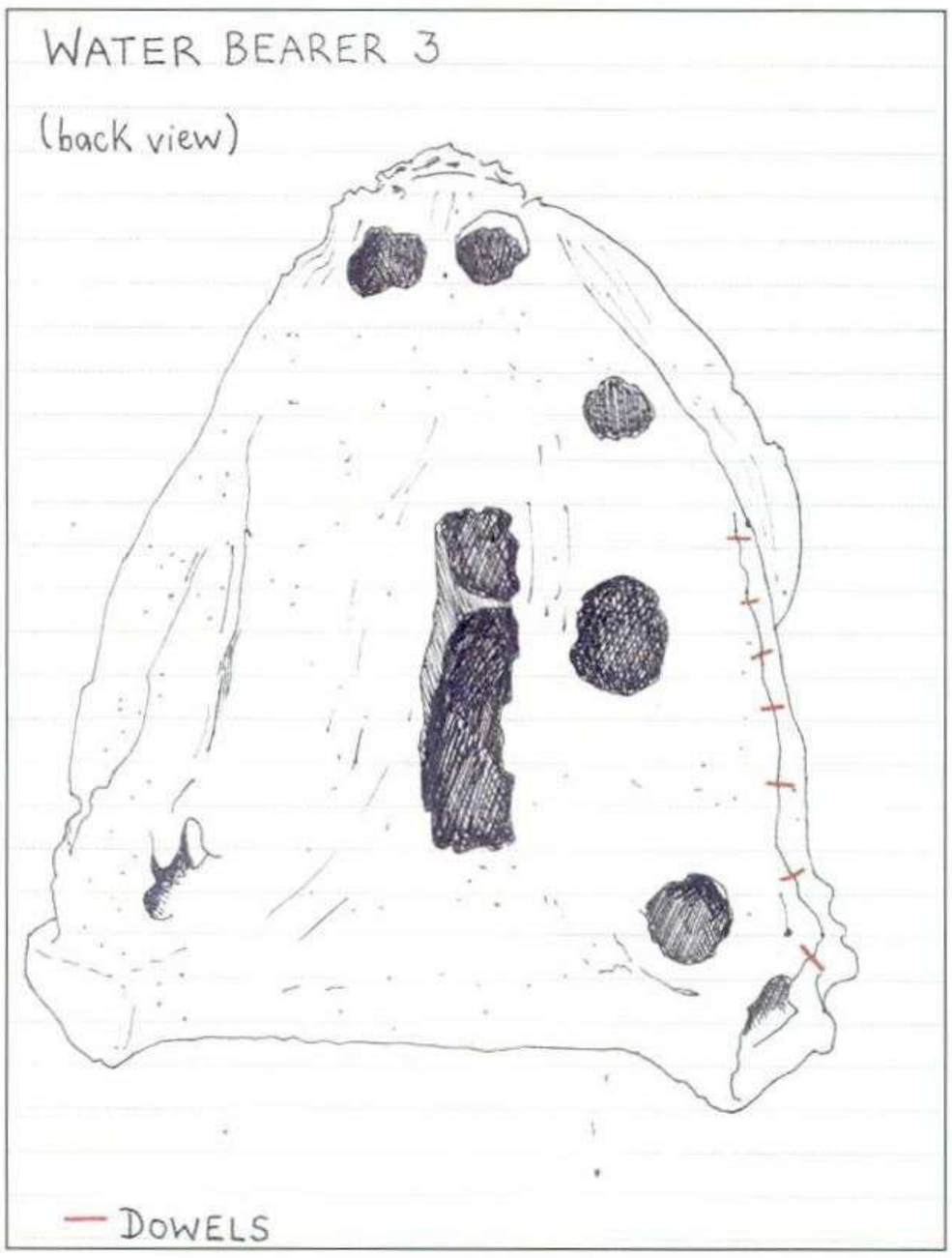
BACK

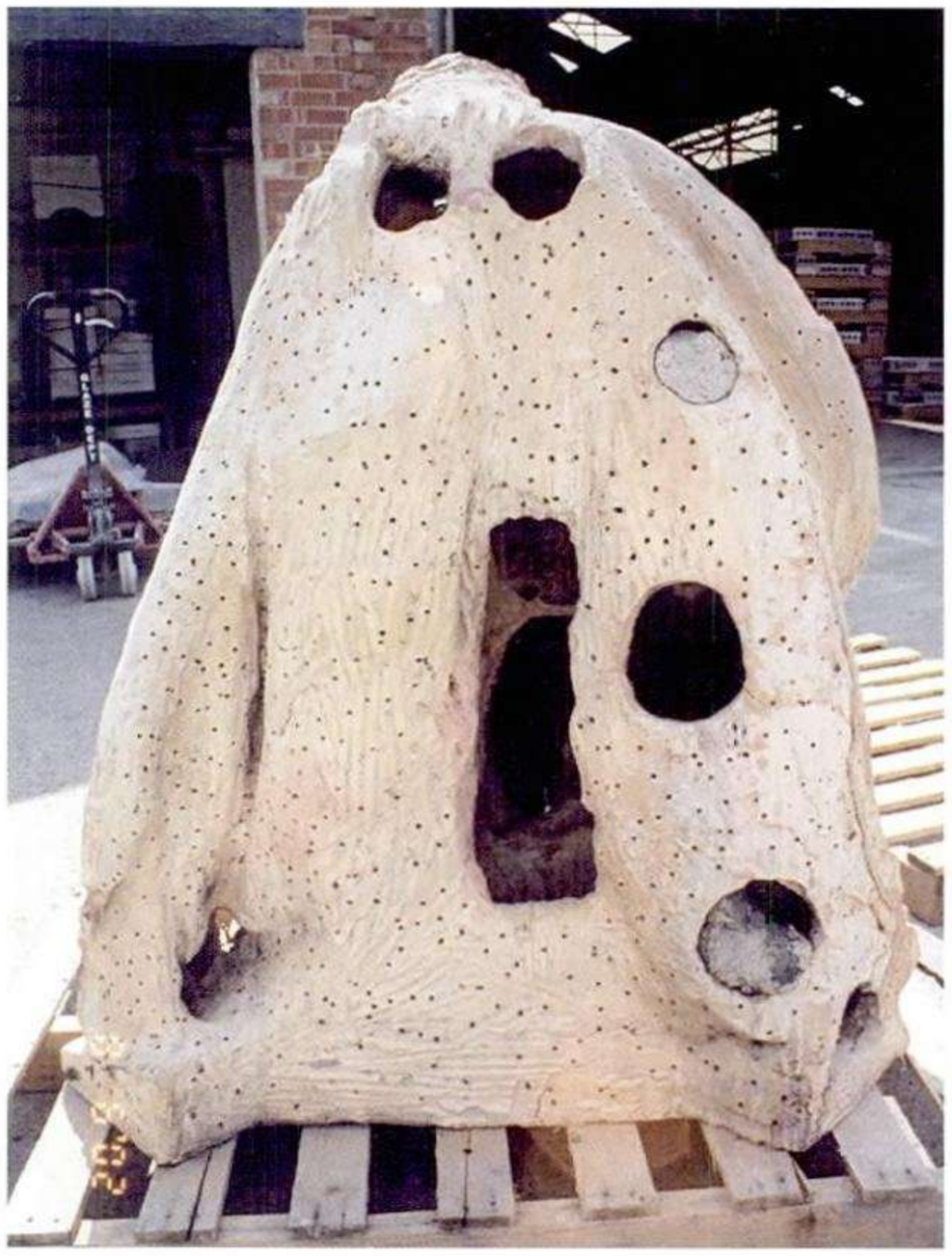
(Carthy Conservation)

(Nicola Ashcroft)

Record of the conservator's works to the legs and base of the Royal Irish Fusilier.







Record of the conservator's works to Water Bearer No. 3, preparing the figure for internal dislplay. *(All Carthy Conservation)*

5.9 Retention of all Pieces of Original Sculpture

As work proceeded the high quality of design and workmanship employed to produce the original sculptures became increasingly apparent. This confirmed the early policy decision to keep as much of the original as possible on the fountain. Where this was not possible the pieces were retained and stored by Glasgow City Council.

5.10 Replacement Pieces of Terracotta Sculpture

5.10.1 Parameters for the Production of New Pieces

While many of the detailed repairs undertaken to the sculptures were not uncommon in the work of the Conservators, the replacement of portions of pieces rather than complete pieces of terracotta was innovative. The process was particularly difficult to achieve as the new pieces needed to be:

- Modelled 8% larger than the original to accommodate the shrinkage of the clay.
- Accurately replicate the missing features and capture the artistic style of the piece of a whole.
- Match the colours, textures and tool marks of the original clay body.
- Be finished to a discreet line within the original piece, so that the eventual join between old and new was harmonious to the whole piece.
- Be fitted to the original terracotta with a minimum of adjustment to both the old and the new.

It was the final three processes that required closest working between the Conservators and the Terracotta Manufacturer.

5.10.2 Preparation of the Original Piece

Where a portion of the piece was to be made, the original piece was first prepared by the conservators to the line from which the new was to originate. The new piece was modelled, moulded, pressed, finished, dried and fired by the terracotta manufacturer. The new piece was then prepared by the conservators to fit the original piece. The eventual fixing of new and original together often did not take place until both had been transported to Glasgow and the whole sculpture had been built in to the fountain.

The new terracotta heads to the Australian lady and the South African man are positioned on the original torsos. *(Nicola Ashurst)*

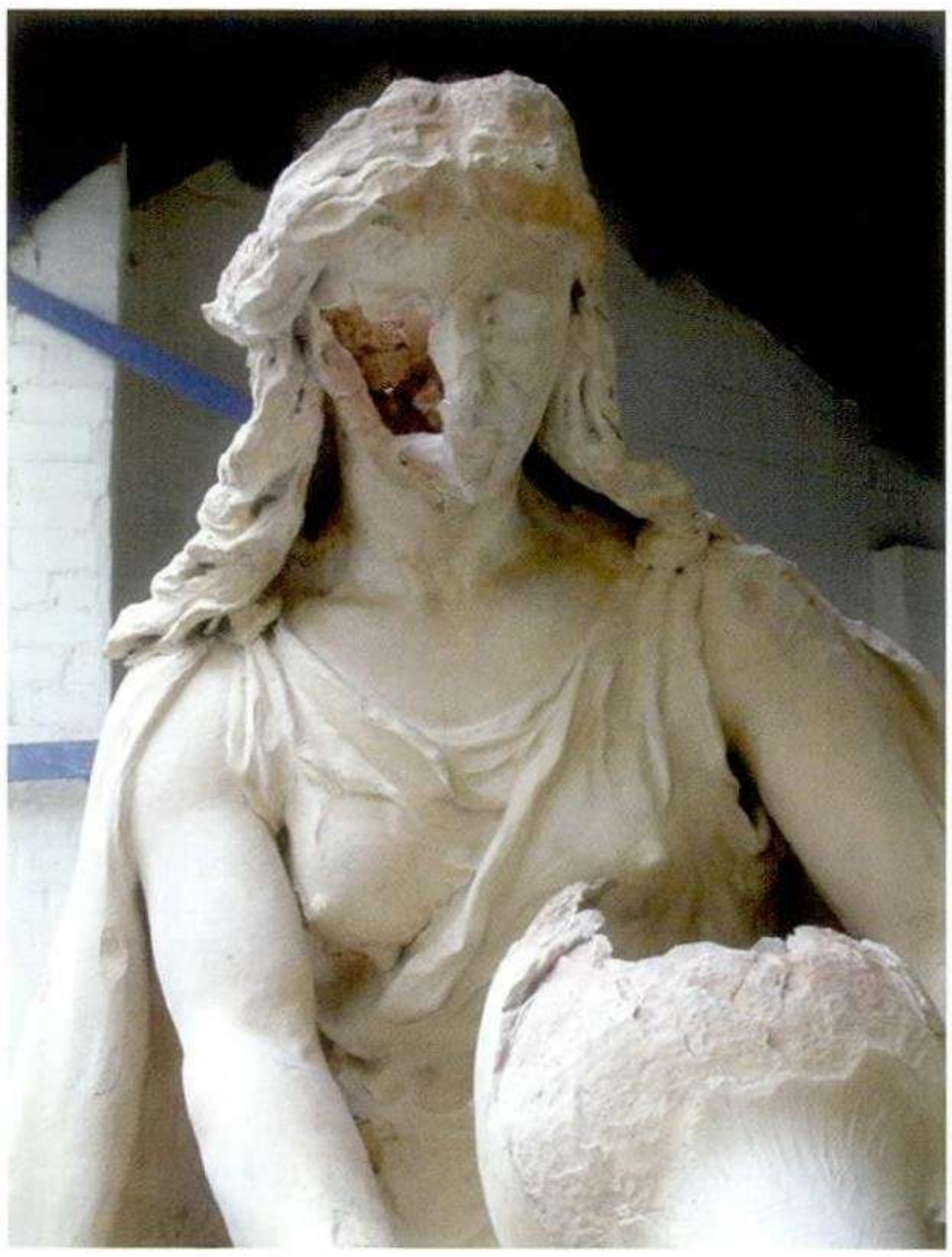
The remaining fragments of the Canadian lady's torso have been reassembled and documentary evidence collected in preparation for modelling of the new piece. *(Nicola Ashurst)*

5.10.3 Use of the Existing Pieces as Evidence

Where a sculpture piece had been severely vandalised and was to be replaced, all remaining pieces were located. With the assistance of archival photographs these were temporarily reattached from the rear.

The replacement pieces were based on as much original material as possible. Archival records were also on display throughout each replication, being relied on more as the amount of original terracotta material diminished.

The new pieces of terracotta were made within the character and detail of their original design and not "corrected". The original sculptures were well detailed when in direct line of sight. Beyond this the sculpture form very quickly reverted to a basic shape. This approach was also adopted in the replacement pieces.



The replacement Water Bearer No. 1 was based on the original piece. The photographs show the original sculpture and the clay model.

(All: Ibstock Hathernware)

(Nicola Ashurst)

(Nicola Ashurst)

(Ibstock Hathernware)

(Nicola Ashurst)

The heavily damaged head and torso of the Royal Irish Fusilier were reconstructed before the replacement piece was modelled. Evidence of the original piece was crucial when the soft clay emerged from the mould and was finished by hand.

The corner base block to Canada was so weathered that recreation of the beaver could not rely on the original piece but had to concentrate on an early photograph and internet research on beavers.

(People's Palace Museum)

(Nicola Ashurst)

5.10.4 The use of Documents

Where no original material remained, replication of pieces needed to be based completely on archival references. The historical records that had been located by GUARD were invaluable. The terracotta manufacturer also found it necessary to undertake a substantial amount of additional research, to resolve details which were not visible from the historic documents.

Although the level of existing archival references was good, the three dimensional nature of the sculptures was particularly demanding of the existing information. Details which were not visible from the historical documents included the missing portion of guns, hats, military buttons, details of the beaver from the Canada group and the horse and riders from the India group. The additional research process revealed that, particularly with the services figures, that military and naval detailing was not always correct in the original sculptures. There had been substantial artistic licence when the statues were first modelled.

5.10.5 The Manufacturing Process

i) Preparation of the Clay Model

Following collection of all original terracotta fragments and completion of historical research, a clay model of the replacement piece was made. During its preparation the terracotta consultant visited the Hathernware workshop to discuss the sculptures' development.

Because the clay model was prepared 8% larger than the original fired sculpture, to allow for shrinkage,cross evaluation between new and old was a difficult process. It was also found that the differences in colour and texture between the clay model and the original piece further complicated the comparison process. The lighting of each piece was another factor where the 'mind' had to override the 'eyes' initial reaction. The new and the original terracotta pieces were not going to be directly comparable until both were fired pieces, quite a long time in the future.

At the end of the clay modelling phase, photographs of the completed piece were emailed to the Project Team in Glasgow for consideration and approval. The approved clay model was recorded by digital photography.

ii) Preparation of the Mould

The clay model was then coated in shellac. After that a mould of it was prepared. Some moulds were very intricate and formed of over one hundred pieces. In the process of mould making the clay model was necessarily sacrificed.

iii) Pressing of the Mould

Once the mould was dry the selected clay was pressed by hand into its outer surfaces, to thicknesses of 35-45mm.

(Nicola Ashurst)

(Ibstock Hathernware)

(Nicola Ashurst)

The clay model of Water Bearer No 1 coated in shellac, during making of her mould and in the process of unpacking the mould pieces.

A lengthy process of evaluation of all the cleaned sculptures had been undertaken, in order to select the best clay colours for the new sculptured pieces. This was a complex process because of the "multi colour" of the surfaces of the original pieces, which had arisen mainly from the finishing and firing of the original pieces. The clay colour selected was the most dominant of these colours. For simplistic reasons it was called the "yellow" clay.

iv) Finishing and Drying of the Pressed Piece

After the pressed piece had dried sufficiently for the clay to shrink back from the mould, the mould was removed. The surface of the piece then received a substantial amount of surface finishing that was necessary to replicate the very deep and intense surface textures and details of the original piece.

The original pieces had been made direct, modelled in clay without the use of a mould. This process could not be replicated by the manufacturer, hence the need for the high amount of finishing to the pressed pieces.

Once finishing of the surface textures was completed the pieces were wrapped in hessian and left to dry very gradually over periods of up to seven weeks. Some had to have support saddles and others complex systems of rollers, in order to control and accommodate the shrinkage of the clay and to avoid the sculpture pieces cracking. At times the design and manufacture of these devices was more complex than the preparation of the sculpture itself.

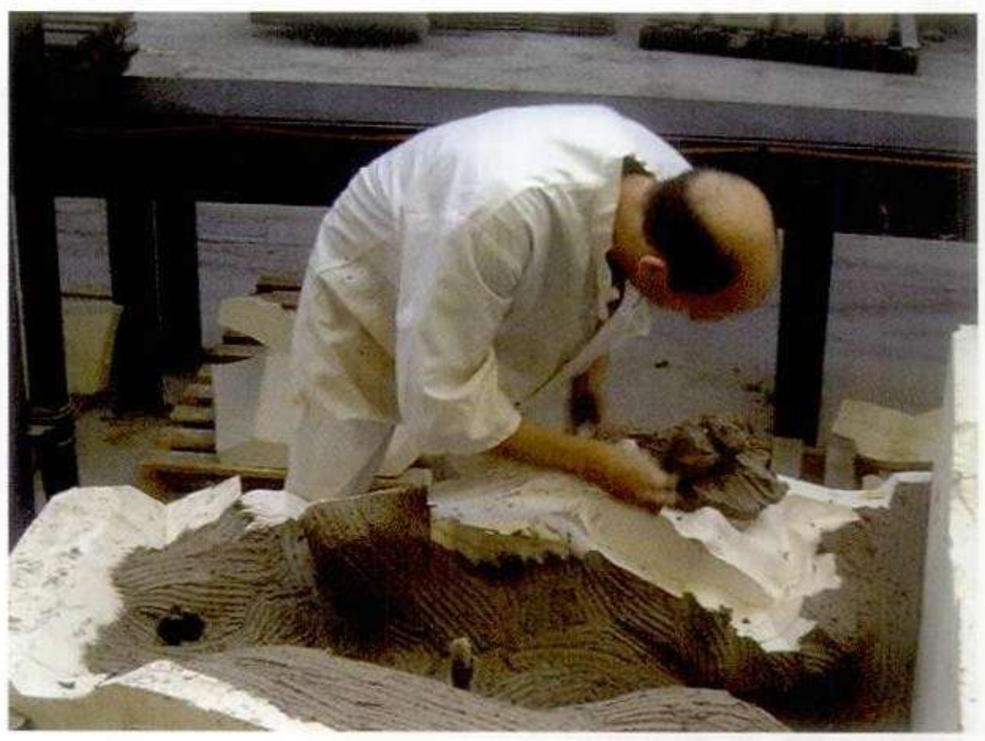
v) Finishing

On completion of drying the pieces were fired. Very few shrinkage cracks developed in the kiln. There were no firing "failures". In only one instance was the final colour unacceptable and the piece was remade.

vi) The Completed Pieces

The new pieces of sculpture were then test-fitted to the new with as many adjustments between new and old being made in the workshop. Where new portions of sculpture were made, fitting was undertaken by the Conservator. Otherwise the junction between old and new pieces was the responsibility of the terracotta manufacturer.

(Nicola Ashurst)



(Ibstock Hathernware)

(Ibstock Hathernware)

(Ibstock Hathernware)

Part of the mould of one of the Water Bearers: its pressing, dismantling and the head awaiting hand finishing.

(Nicola Ashurst)

The finished figure of Water Bearer 3 covered in hessian and reclining on a support saddle, during the 8 week drying out period.

(Nicola Ashurst)

The finished sculpture of Water Bearer No. 3 dries out on a sacrificial base and multi directional rollers designed to control drying-out shrinkage. *(Nicola Ashurst)*

6 MANUFACTURE OF REPLACEMENT TERRACOTTA BLOCKS

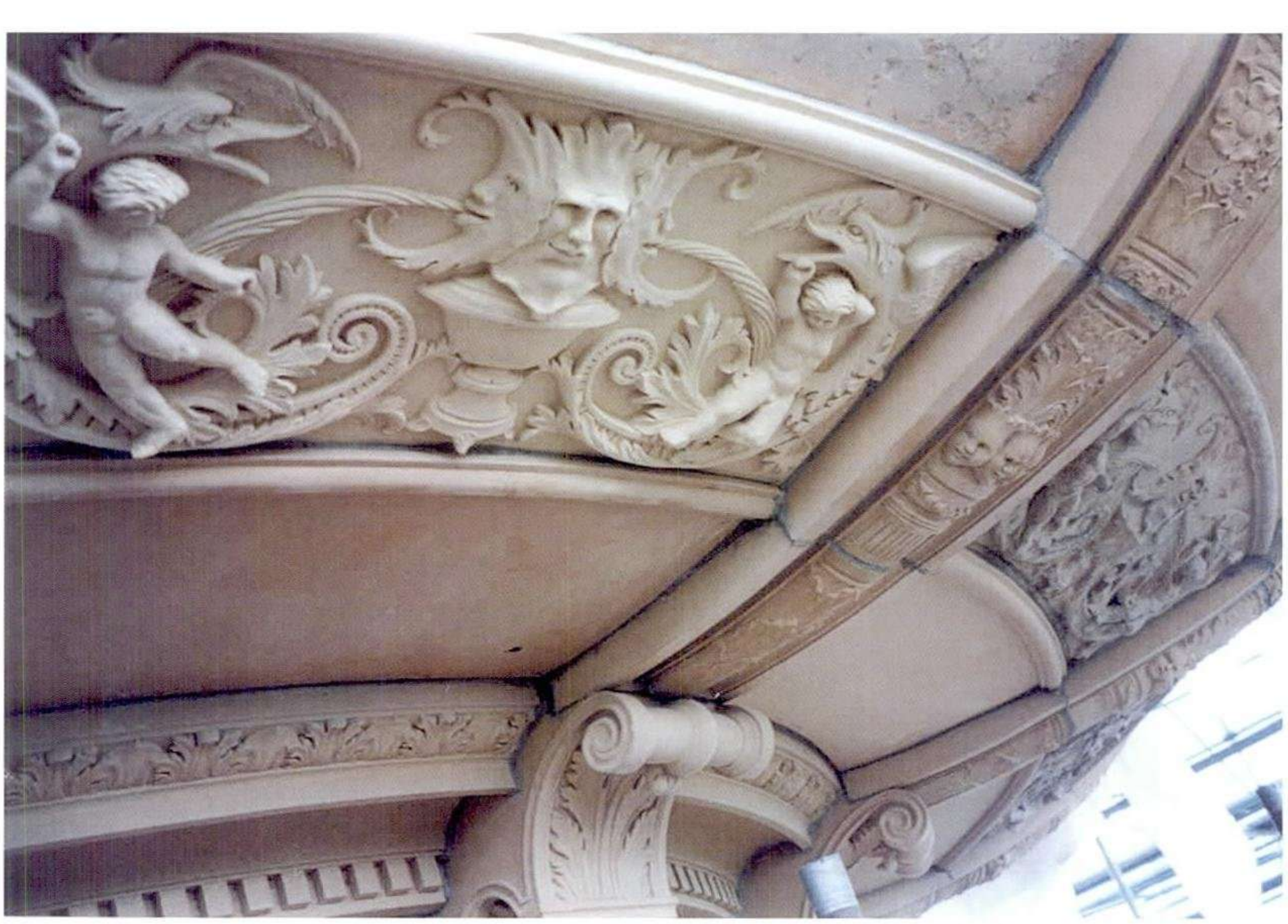
6.1 Colour Matching of Clays

6.1.1 Colours of the Blocks

Production development began with the selection and cleaning of blocks representative of the several hues found on the fountain superstructure. Not every section of the fountain had clays of the same colour or the same number of colours although there were a few colours which were common throughout. The distribution of colours was as follows:

B Series (Outer Basin, Outer Wall)	3 Colours
C Series (Inner Wall to the Outer Basin)	5 Colours
D & E Series (Piers between the Colonial Groups)	2 Colours
F Series (The Cantilevered Basin)	2 Colours
G Series (Between the Service Figures)	2 colours for the niches 2 colours for the pilasters
H Series (Water Bearer level and above)	3 colours were used for the original blocks and previous replacement units.

Six clay colours in total needed to be matched, for the replacement blocks.



The pieces of the cantilevered basin were four different colours. Replacement terracotta reflected this diversity. *(Nicola Ashurst)*

6.1.2 Clays for the Blocks

The 6 clay colours were based on the following clay:

1179: CLAY BODY MIX	
Caughley Clod Fireclay	1250kg
North Devon Ball Clay	1250kg
Barium Carbonate	10kg
Grog	1500kg

Reference: *Ibstock Hathernware records*

Selection of one base clay gave the same shrinkage to all the blocks.

In addition to the above base clay, stains were added to arrive at the six colour variations. The colours were achieved as set out in the table below:

Colour Reference	Colour Name	1179 Clay	5824M Stain *	5820H Stain *
A	Pink	15 cwt	15 kg	
B	Light Pink	15 cwt	7.5 kg	
C	Buff / Pink	15 cwt	22.5 kg	11.25 kg
D	Yellow	15 cwt	11.25 kg	15 kg
E	Orange/ Pink	15 cwt	30 kg	3.75 kg
G	Yellow / Pink	15 cwt	20 kg	15 kg

Reference: *Ibstock Hathernware records*

*The proprietary stains were supplied by:

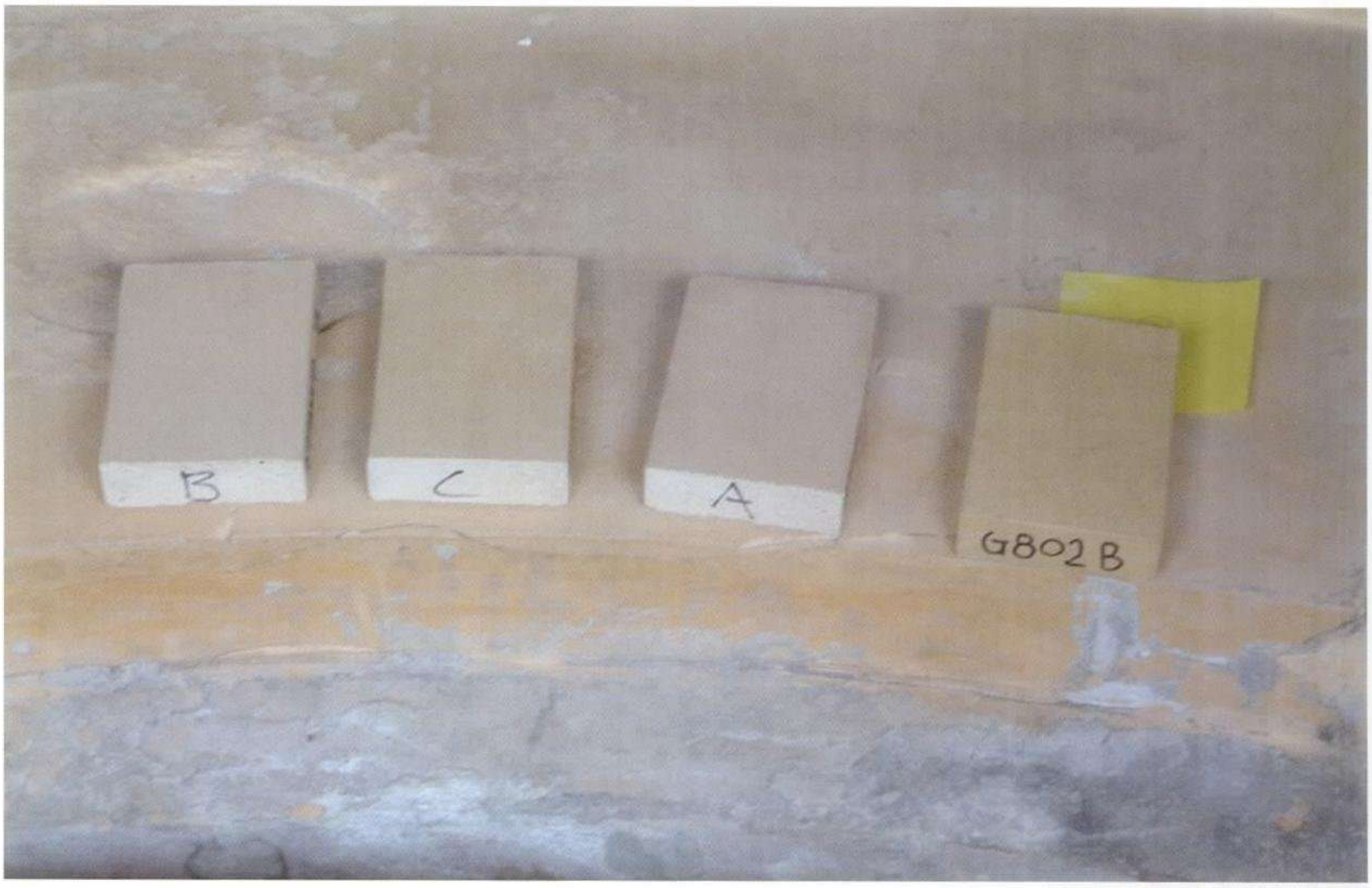
ATC Colours
Vale Works
New Haden Road
Cheadle
Staffordshire
ST10 1UF
Telephone: 01538 754400
Fax: 01538 751212

Website: www.atcolours.co.uk

6.1.3 Colour of the Original Sculptures

While the sculptures all had a distinct overall buff (yellow) colour to outer surfaces, close inspection of damaged areas showed this colour to be only 2mm thick. Beneath this the clay was orangey pink in colour.

The visual effect of the yellow surface on the pink clay under body was akin to that of glazing. It was speculated that the differently coloured outer layer had been caused by a spray coating of the finished piece with a clay slip or by dipping the pieces in clay slip or liquid stain. Neither of these methods could explain why the colouration was on every unseen surface, nor the consistency of its thickness. The outer colour was not a separate layer. In order to understand how the effect had been achieved fragments were analysed. Energy Dispersive Analysis (EDA) suggested that the pink areas contained a higher level of calcium sulphate (gypsum) to the outer layer of buff but no final conclusion could be drawn from the analytical results.



Four of the six clay colours selected for the replacement teracotta to the fountain. *(Nicola Ashurst)*

During early development trials a piece of the original sculpture material was fired in a production kiln to around 1170°C. The pink of the under body burnt away leaving a through-body buff colour. The piece also shrank suggesting that the outer buff layer was the result of higher firing temperatures.

The most plausible explanation was that calcium carbonate mixed with the clay was burnt out of the surface zone leaving the yellow colour, but not out of the inner core where the critical temperature had not been reached.

Replicating the technique which achieved the two colour clay body was not considered to be as advantageous as achieving the correct colour to the surface of the clay and having a superior frost resistance throughout the full clay body.

6.1.4 Colour and Clay for the Sculptures

To match its dominant buff colour, Ibstock Hathernware clay 1140 was chosen as the best average colour that would blend with the several subtle shades on the original pieces.

The constituents of 1140 Clay Body Mix were:

Scottish Fireclay	575kg
Yorkshire Fireclay	600kg
North Devon Ball clay	480kg
Shropshire Measures	960kg
Felspar	475kg
Barium Carbonate	20kg
Grog	900kg

Reference: *Ibstock Hathernware records*

The chosen buff clay body for the sculptures was one that had been in use for a considerable time at Hathernware. Its physical properties were well known and its pressing, drying and firing characteristics had been long established. This was an important basis for the production of such large pieces.

6.2 Replication of Original Details

Throughout, the original construction details of the terracotta were replicated. In a few locations the original detailing was not totally satisfactory but could not justifiably be altered. A good example of this was the terracotta saddles which hung over the arms of the cantilevered basin and supported the spandrel panels. Their detail could not be improved on without redesigning and replacing all the support and spandrel units to the cantilevered basin. This and other such details were therefore replicated, manufactured as carefully as possible to avoid any unnecessary stress being introduced into key junctions.

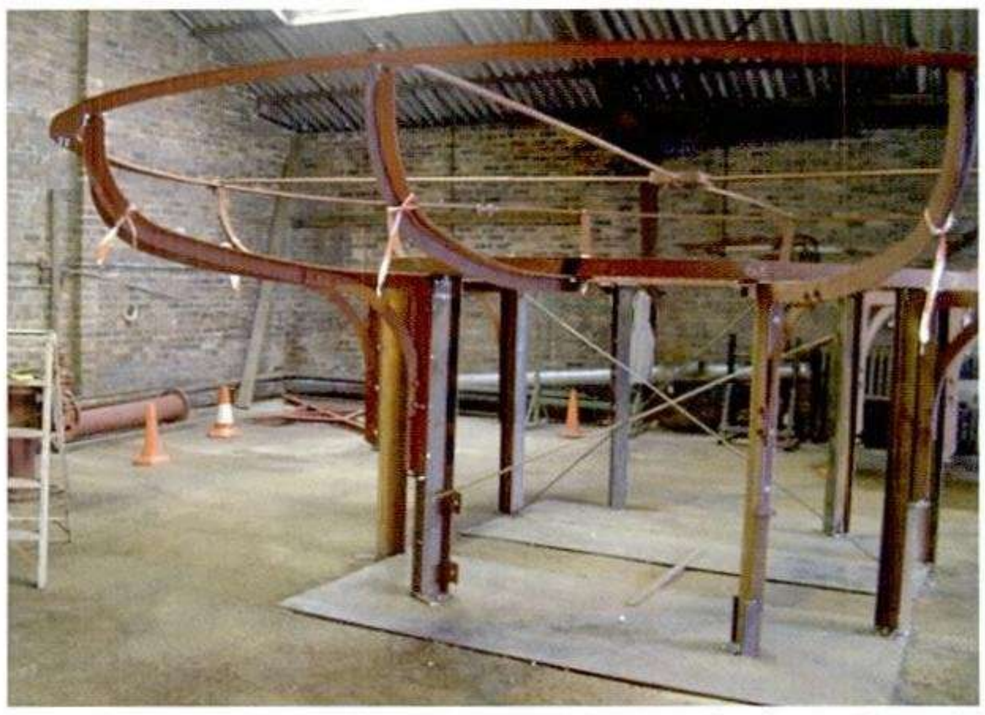
The one exception where original detail was altered was the ashlar course at water level on the inner wall of the Outer Basin (C-Series Blocks). The bottom edges of the original blocks had been trimmed by about 35mm during a previous repair programme, puncturing through the outer wall of the units and permitting water to enter. The original, trimmed units were interspersed by replacement units in yellow terracotta whose bottom edge matched the trimmed line of the original units. Following agreement with Historic Scotland the whole of this course was replaced with the new units made to follow the line of the previous replacements in order to avoid this course being saturated in water.

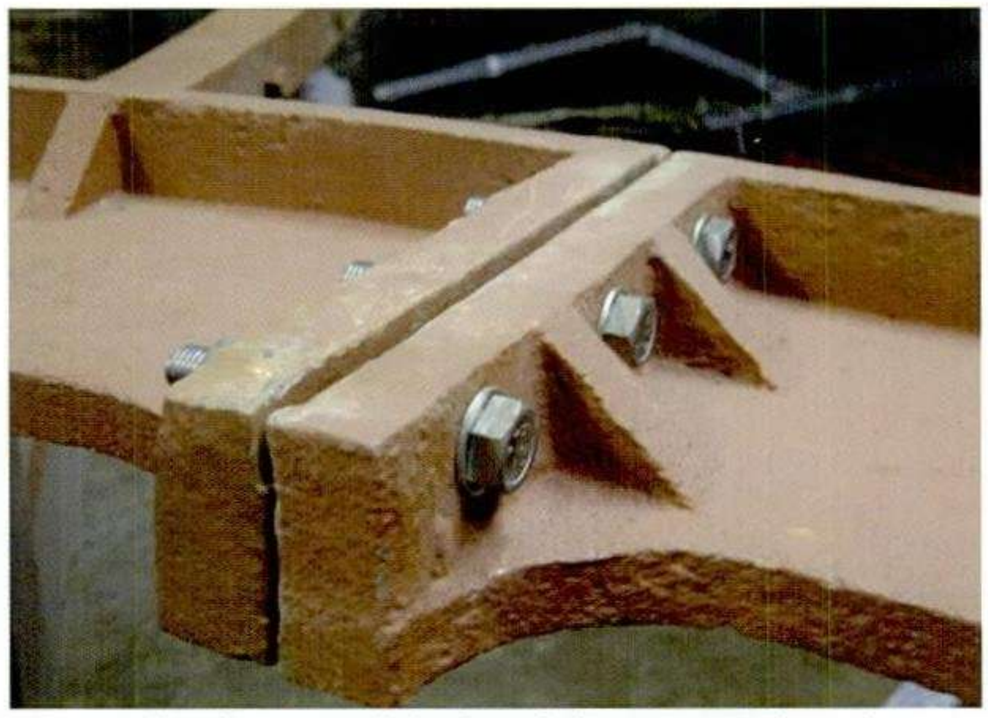
6.3 Manufacturing the Replacement of Terracotta Blocks

i) Manufacturing drawings

Information necessary for the preparation of full scale drawings of each block which needed to be replaced was obtained from on site measurements. In addition because of the downtaking of the fountain, as many of the more detailed blocks as possible were transported to the manufacturers workshop for the taking of details there. All blocks with individual details were transported, for example, the named blocks for the Colonial Groups.

Computer drawings for each block were prepared to full size plus the shrinkage allowance for the clay being used. The drawings provided the information for the





The cast iron and wrought iron support structure for the cantilevered basin is erected so that internal details and dimensions to the replacement terracotta blocks could be determined. The original pieces were too damaged to determine these. (Nicola Ashurst)

production of a pattern of each block type which needed to be replaced.

The iron frame of the cantilevered basin had to be reconstructed so that the internal surfaces of the blocks could be detailed correctly and fixings allowed for.

ii) Pattern Making

The patterns of each block were made out of Plaster of Paris and wood. Once completed they were coated in a mixture of shellac and wax to stabilise the surfaces and to prevent any further drying out of any individual detailing which had had to be applied in clay.

iii) Mould making

Plaster of Paris moulds were then made of each block. Each mould had to be made in sufficient sections which would enable the pieces to be lifted away from the pressed clay without disturbing any of the details. The mould was then left to dry.

iv) Pressing

Once the completed mould had been reassembled and strapped together the selected clay was hand pressed into its outer surfaces to thicknesses of 30-40mm. A system of internal supports, called webs, were built in to stabilise the block as it dried and control shrinkage.

v) Demoulding and finishing

Once the pressed clay had shrunk away from the surface of the Plaster of Paris mould, it was released and its surfaces finished using small, hand-held pieces of leather, spatulae and rounded knives. This process was necessary to smooth the clay surface, to press in any pieces of previously fired clay (grog) and to replicate the detailed characteristics of the original blocks.

vi) Drying

The damp blocks were then set aside in the factory drying room to slowly dry. As approximately fifty percent of the shrinkage of a block takes place during the drying period, temperature conditions during this time were carefully controlled. Initially blocks were kept under hessian covering. For the larger pieces a series of slabs and rollers were necessary to enable the block to accommodate the large amounts of shrinkage taking place.

Smaller blocks took about three weeks to gradually dry out. Larger or more complex blocks took four to six weeks.

vii) Firing

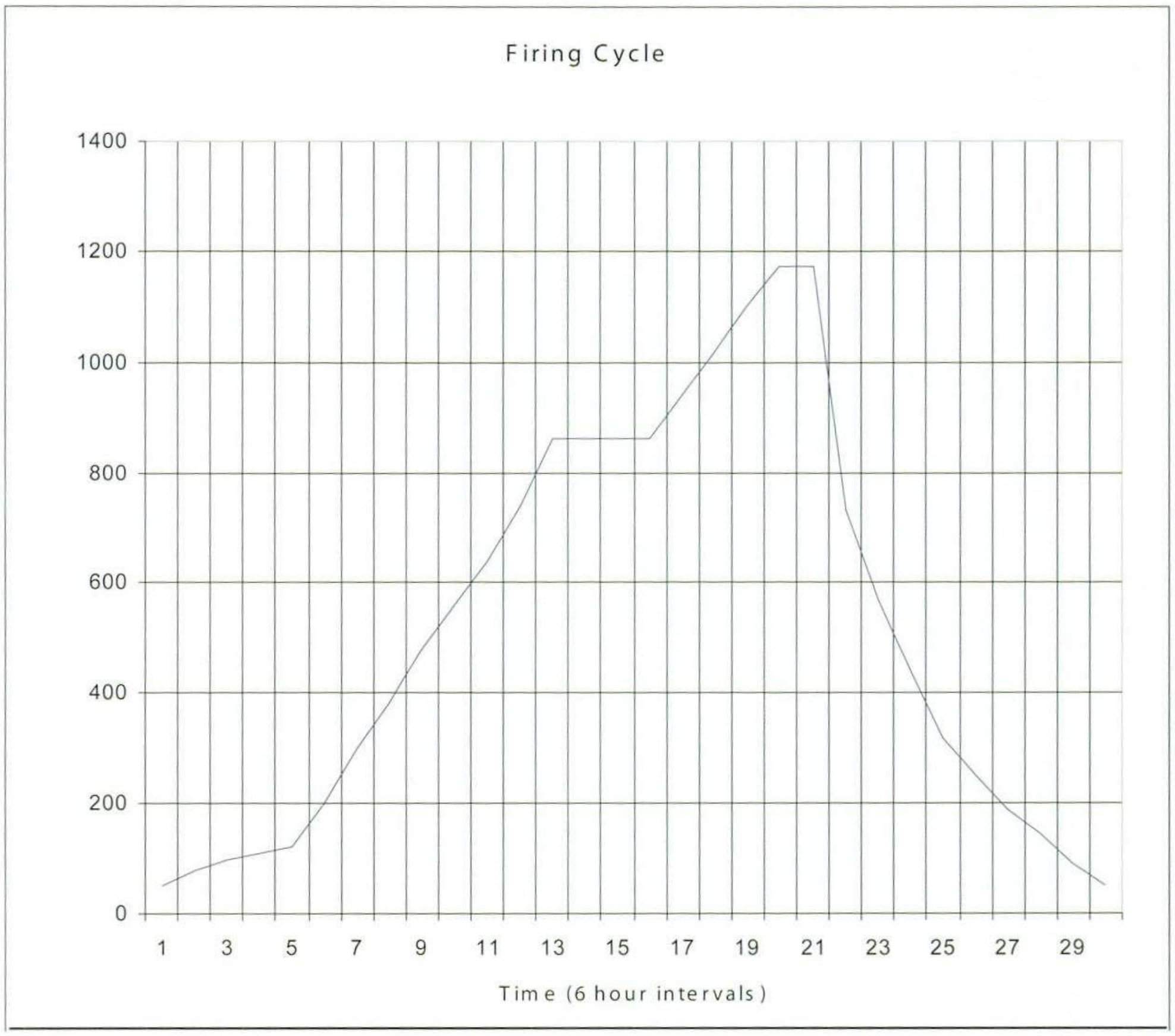
The dried blocks were then placed in the kiln and fired over a seven day period. The first thirty hours of firing achieved the removal of the last traces of combined water with the ambient temperature of the kiln being raised to slightly over 100°C. A slow rise in temperature over this period ensured that water did not turn into steam with the expansive force that could potentially damage the work in the kiln and possibly the kiln itself. Thereafter the temperature in the kiln rose by approximately 100°C every six hours until around 850°C when a period of "soak" for approximately nine hours allowed the entrapped carbonaceous matter in the clay to burn away as gas. After that the temperature climbed further, approximately 100°C every six hours, to 1170°C when a short period of "soak" ensured the clay core had received the same firing temperature. Cooling was then carefully controlled to return the kiln to ambient temperature.

viii) Packing and transportation

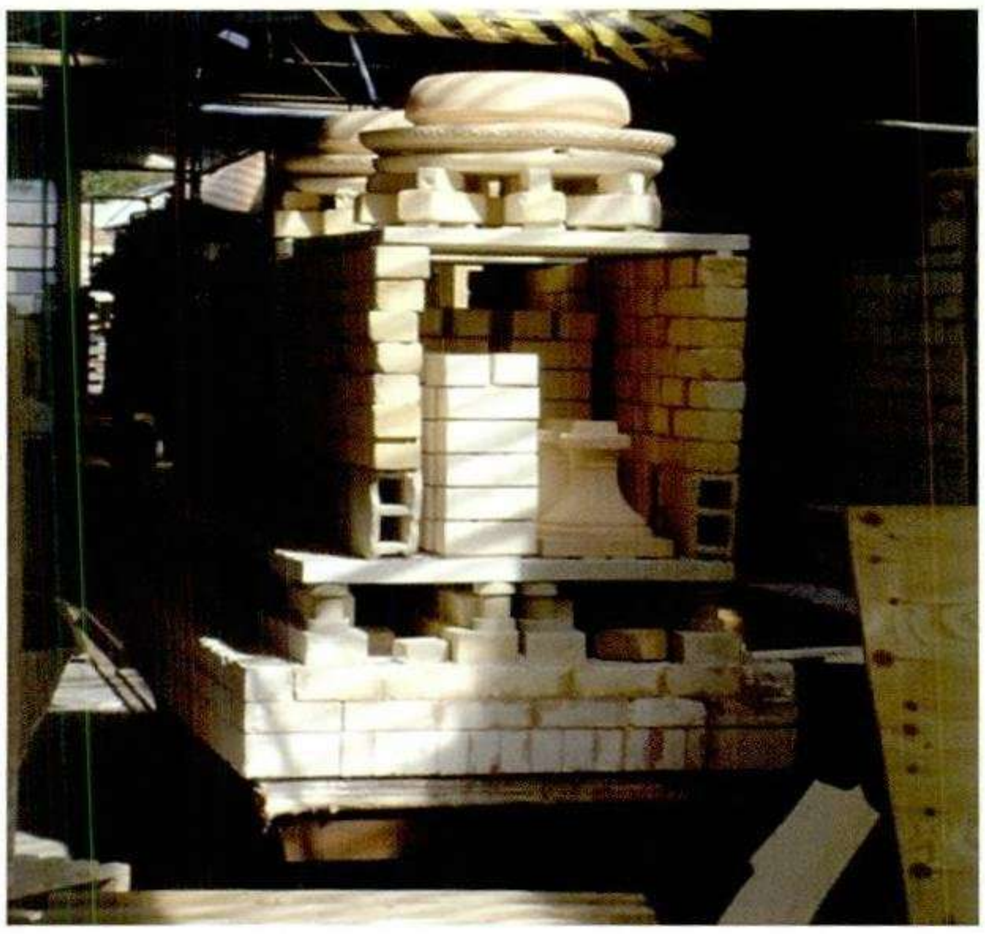
Once out of the kiln the blocks were placed on new pallets, shrink wrapped and transported back to site.

6.4 Sequence of Production

The sequence of manufacture of the blocks tracked the of reconstruction of the fountain. Certain pieces threatened to upset this sequence, in particular, the spandrel panels to the cantilevered basin which were the most challenging to make.



The temperature and duration of a firing cycle. (Ibstock Hatherware)



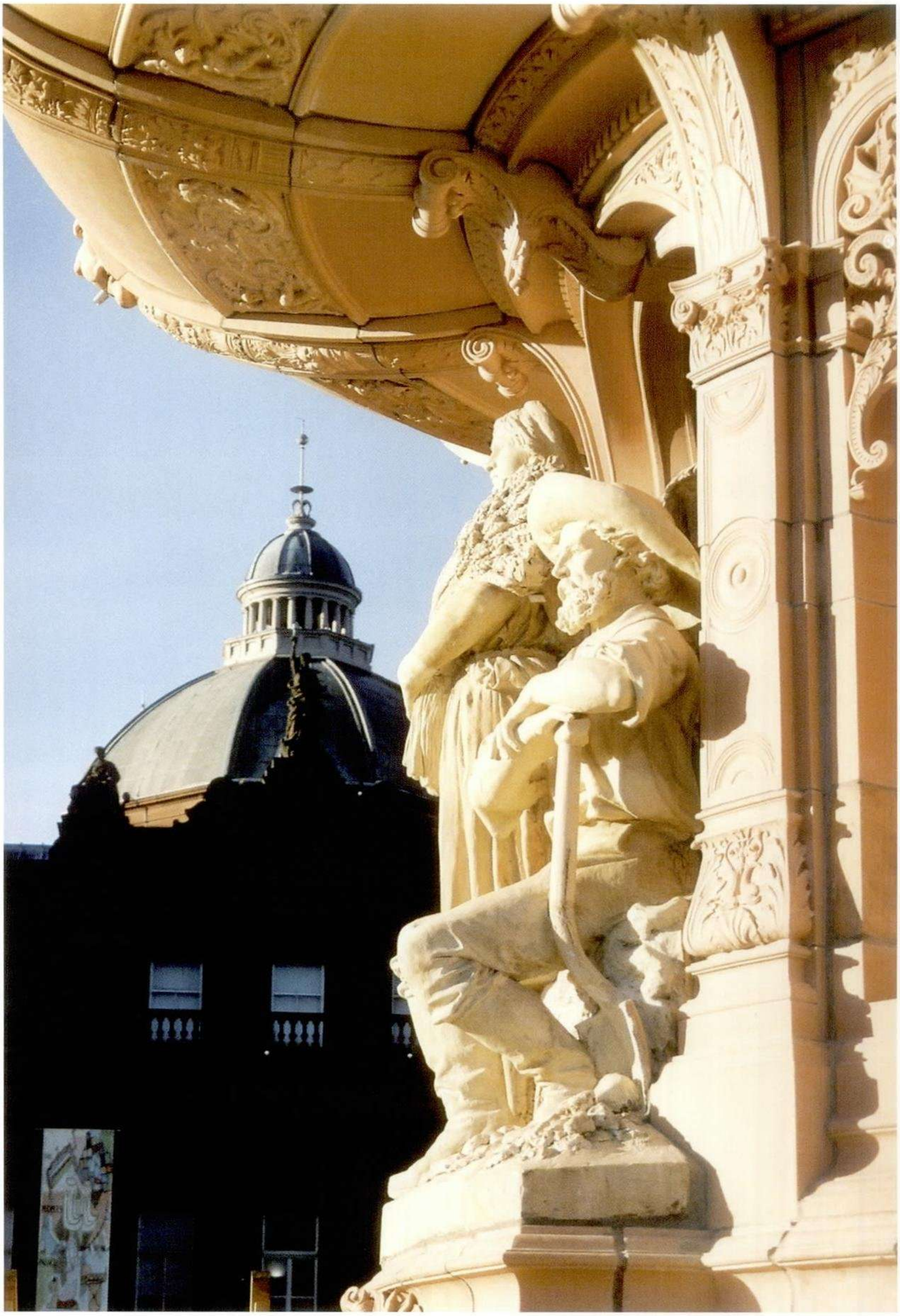
A kiln trolley emerges from the kiln. *(Nicola Ashurst)*

A fired lion head for the cantilevered basin. *(Nicola Ashurst)*

Making moulds of the decorative blocks required close study of the original piece. The decorative elements were made by the sculpture modeller and applied to the base shape prepared by the model makers. *(All: Ibstock Hathernware)*

The craftsmen of Ibstock Hatherware who undertook the many processes from clay preparation through to the packaging of pieces ready for transport. Missing from the photograph is Commercial Manager, Geoff Hollis whose unending commitment was key to the success of the project. *(Ibstock Hathernware)*

Front Row: Lenny Smart, Jeremy (Jez) Ainsworth, Steve Pritchard, Jane Wilson, Mark Nicholson, David Dickinson,
Middle Row: Steve Pidcock, Luke Wardle, John Bailey, Tommy Bradbury, Nick James, Alan Hull, David Brown
Back Row: Jon Wilson, Dodge, Paul Smith, Andrew Selby, Colin Selby, Steve Mott, Andrew Spencer



The restored Australia group shelters in its niche under the cantilevered basin. *(Nicola Ashurst)*

7 REBUILDING

7.1 Site of the Reconstructed Fountain

7.1.1 Sub-Surface Constraints

Pre-contract site investigations established that below ground, the new site of the fountain was riddled with services: high voltage cables, a main railway tunnel, fibre optic cabling feeding the main financial institutions in the east of Glasgow, a mains water pipe and gas pipes. Minimal ground vibration and disturbance became essential constraints of the site works and led to the selection of bored piles.

7.1.2 The New Support Structure

A piling and ground beam arrangement was built at two levels. The lower platform was constructed to take the underground plant room and access passage. Walls of the plant room were constructed from reinforced concrete to a similar specification to swimming pool construction. The second upper platform at ground level was formed to support the fountain, with a reinforced concrete upstand under the main fountain forming the base for existing columns and roof of the plant room.

7.2 Revising the Specification

As work proceeded aspects of the specification were revised to reflect the nature and materials of the original construction.

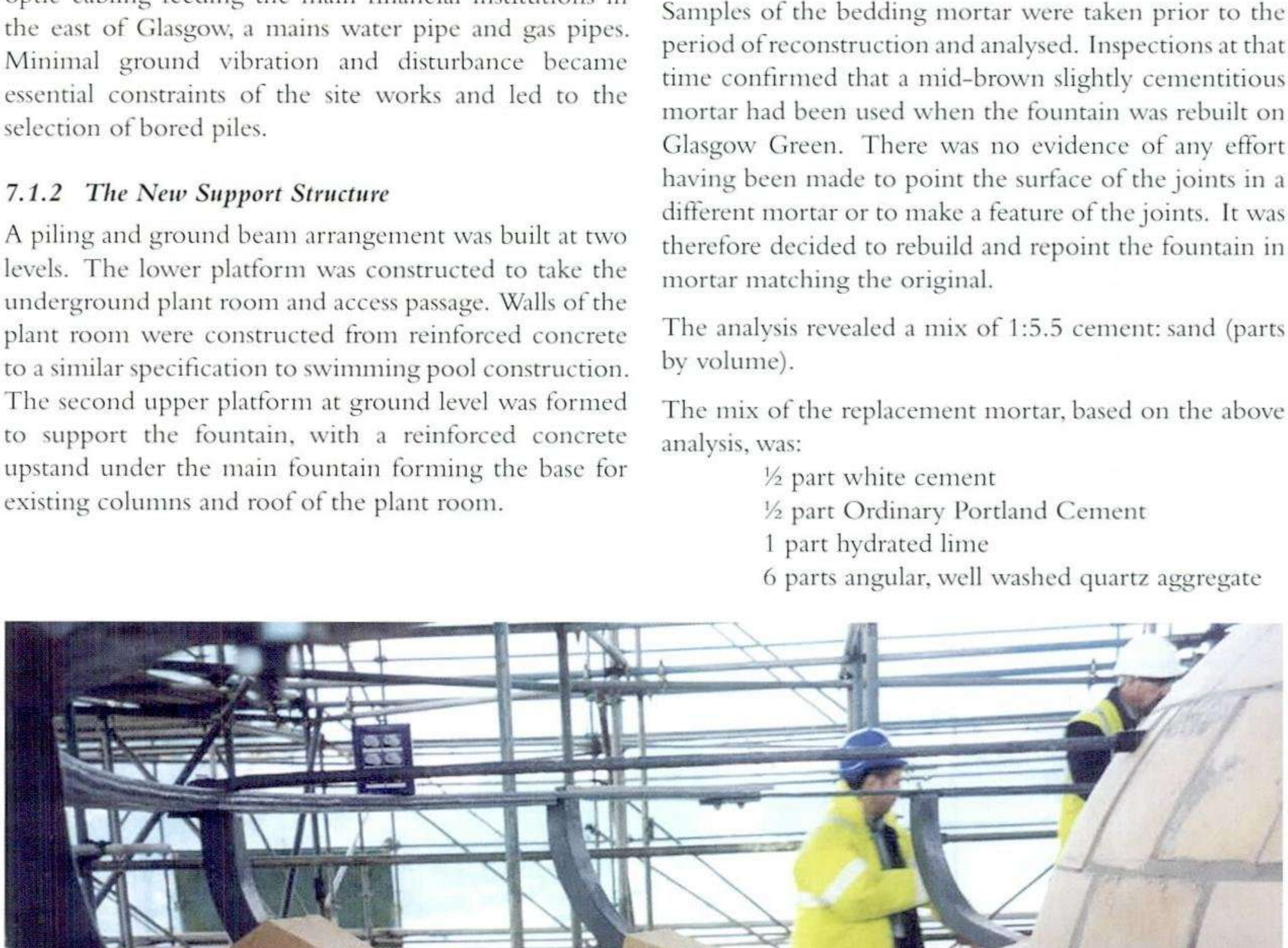
7.2.1 Mortar Analysis

Samples of the bedding mortar were taken prior to the period of reconstruction and analysed. Inspections at that time confirmed that a mid-brown slightly cementitious mortar had been used when the fountain was rebuilt on Glasgow Green. There was no evidence of any effort having been made to point the surface of the joints in a different mortar or to make a feature of the joints. It was therefore decided to rebuild and repoint the fountain in mortar matching the original.

The analysis revealed a mix of 1:5.5 cement: sand (parts by volume).

The mix of the replacement mortar, based on the above analysis, was:

½ part white cement
½ part Ordinary Portland Cement
1 part hydrated lime
6 parts angular, well washed quartz aggregate



Reconstruction of the cantilevered basin began with the saddle blocks to the structural arms. *(Nicola Ashurst)*

7.3 Filling of the Blocks

The fill of many of the original blocks was a weak "concrete" of crushed brick and cementitious binder. As soluble salts were not an issue, this fill was left in place in blocks which were reused.

Once on site the new blocks were filled with a similar concrete of crushed 'special' quality, low sulphate brick ranging in size from 50mm down to 10mm, in a minimum amount of binder of 1 part Portland Cement : 8 parts fine, sharp sand. The water cement ratio of the mix was kept at a low but workable level. The "concrete" was placed in the rear of the blocks and gently tamped by hand. The blocks were left to cure and dry for 7 days before building in.

7.4 The Iron Framework

The cast iron and wrought iron was abrasively cleaned, primed and inspected for defects. Localised strengthening to areas of deepest corrosion was undertaken by welding on patches of mild steel. The completed, repaired iron structure was given a five coat epoxy paint treatment prior to re-erection on site. The inbuilt, upper level cruciform beam was in too poor condition to retain and was replaced in stainless steel replicating the original design.

7.5 Sequence of Works

The rebuilding process worked in exact reverse of the taking down process.

The lower levels of the fountain were rebuilt around the new concrete and brickwork structure.

Stainless steel ties were installed to the back of the terracotta blocks at intervals, to tie the outer skin to the backing brickwork, in a similar fashion to stonework construction.

Above dome level, a light reinforcement cage was installed within the main column concrete to assist with strengthening the core construction at this point. Higher up a new stainless steel cruciform beam was built into the core to replicate the existing at the upper cantilever. Finally a new stainless steel dowel was grouted into the base of Queen Victoria.

The first delivery of new terracotta arrived on site at the end of January 2004. In June 2004 Ibstock Hathernware's parent company decided to close the firm. During its last four months Ibstock Hathernware maintained its programme of delivery and sustained the same level of quality. The Doulton Fountain was the last contract undertaken by the firm.

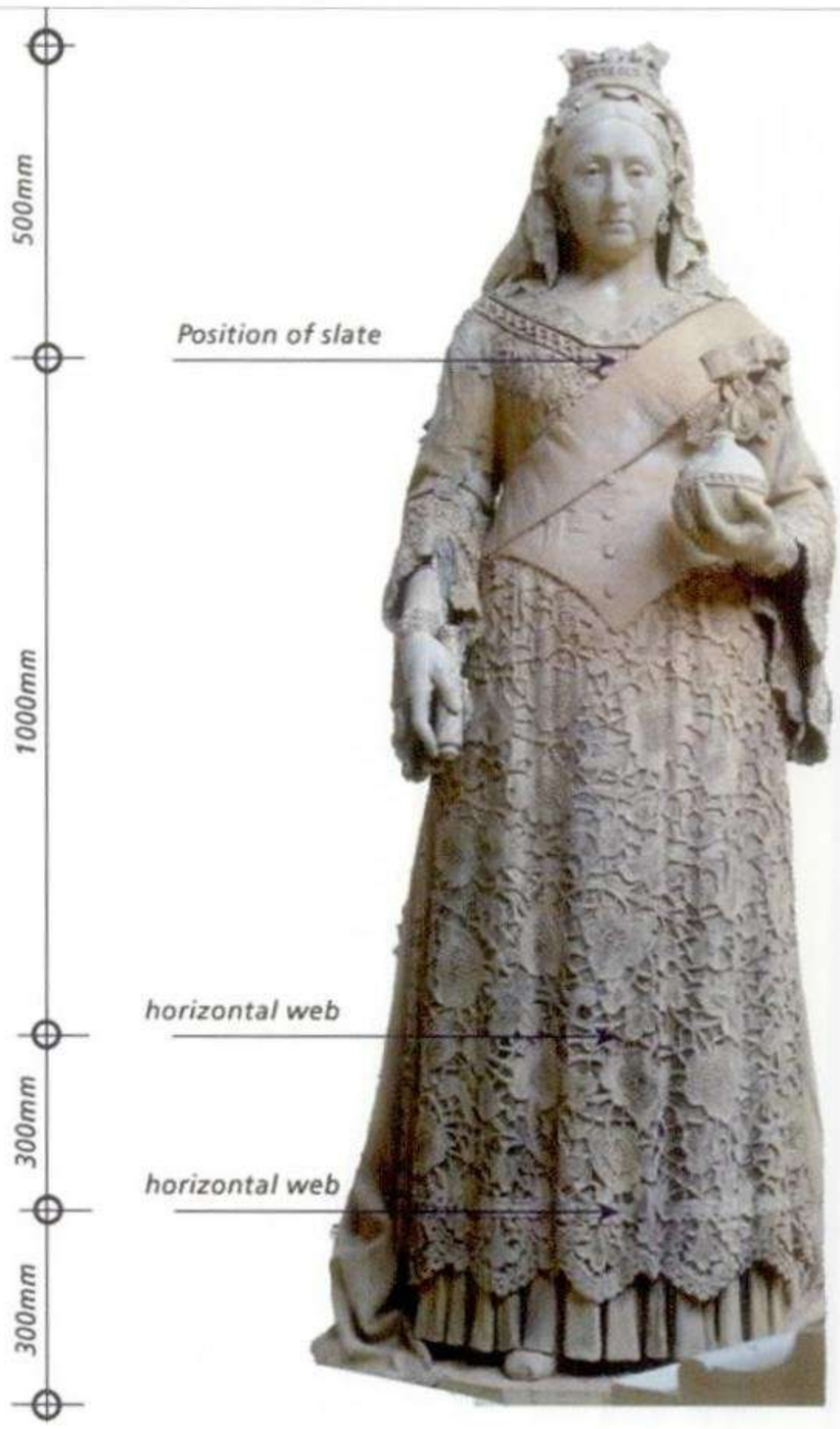
7.6 Trimming of Blocks

It had been anticipated that some trimming of new units would be necessary to obtain a satisfactory fit between them and the original units in the reconstructed fountain, particularly due to the close fit to the original units. There was also evidence that original blocks had been trimmed crudely, to achieve the original fit. Trimming was found most necessary in the reforming of the cantilevered basin, as was the case when the fountain was erected on Glasgow Green in 1890.

7.7 Reinstatement of the Sculptures

Once construction of the superstructure was complete, the terracotta sculptures were fitted. Templates of these had been provided by the Terracotta Manufacturer to ensure that niches were sized correctly.

Reinstatement of the sculptures began in September 2004. It had been established that while the main fitting of the sculpture groups should be undertaken by the specialist contractor, the pointing of their joints needed to be undertaken by the Conservators using the same mortar and skills utilised in the localised mortar repairs.



Inside Queen Victoria

(Ibstock Hathernware)

Victoria was put in place first and a new lightning conductor installed. Investigations of the interior structure of Victoria had been undertaken in the workshop using a small, flexible, CCTV camera. This had confirmed that the void within her dress and torso was made up of a cellular construction, capped at shoulder level with sheets of slate and a bed of mortar onto which her head was fixed. It was therefore not possible to install a lightning conductor internally. The new circular lightning conductor cable, covered in a colour matched plastic, was fixed to the rear of her dress, following much the same route as the original, deeply embedded in the depths of folds to the drapery of her dress and veil. The termination of the conductor was a simple bar located behind her repaired and restored crown.

Next to be fixed were the four new Water Bearers. New water pipes and fibre optic cables were fitted before the sculptures were finally secured.

The four Service Figures followed. Once the major pieces were secured the conservators were able to finish attaching replacement extremities such as bayonets, guns, ropes and buttons to epaulettes.

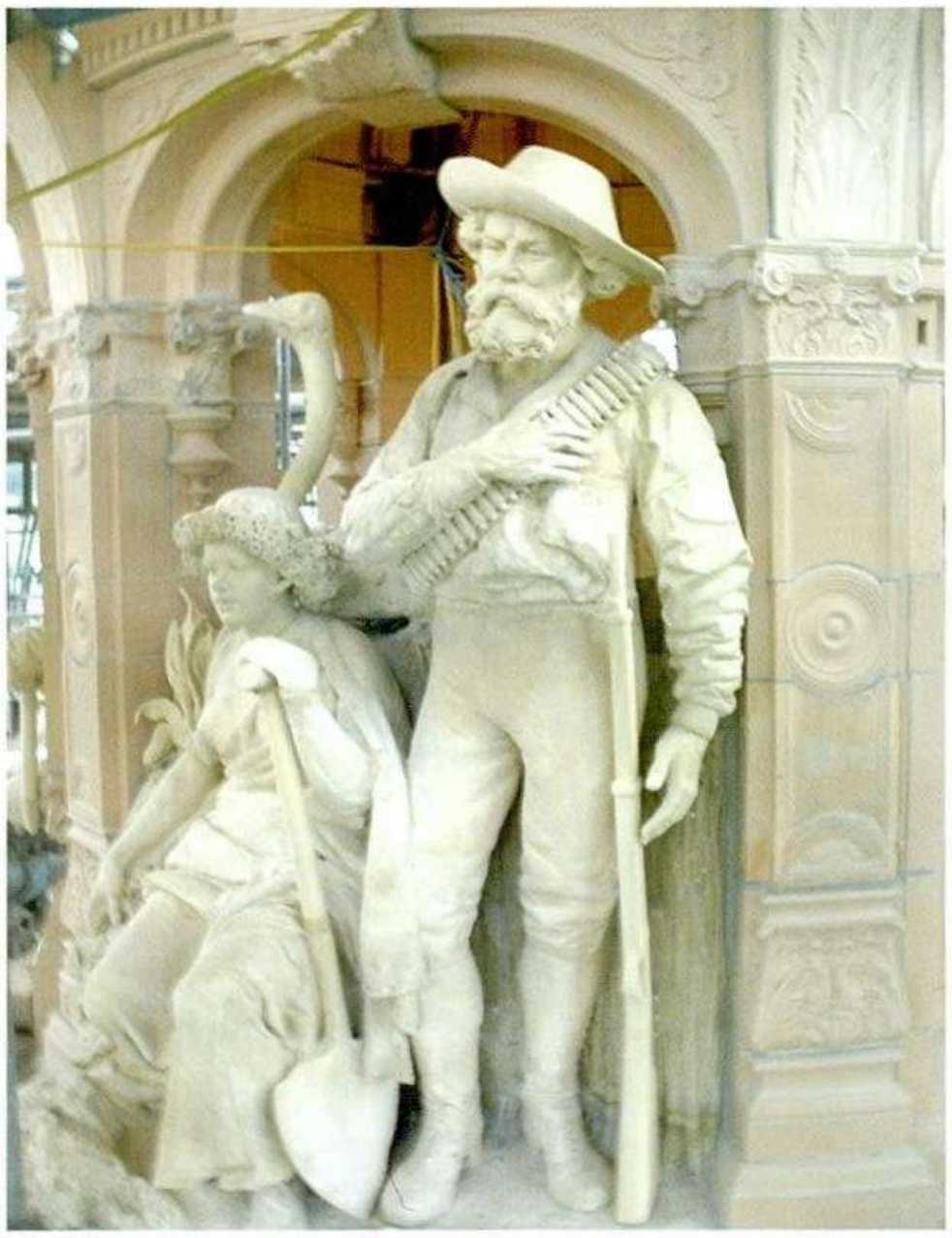
Finally the Colonial Groups were fitted. These required most attention from the Conservators because of the extensive amount of replacement pieces which needed to be married in with the originals.

The torsos of the four St Mungos were not fitted until after the scaffolding and the weather proof box had been removed.

7.8 New Technology

Reconstruction of the fountain included the introduction of several items of modern technology:

- **A new water supply** was designed and installed, following the original pipe routes. The new system uses a re-circulating pump system with automatic top-up to compensate for any water loss.
- A **fibre optic lighting system** was installed in the Water Bearer urns, the eight lion's heads to the perimeter of the cantilevered basin and the four bat heads between the Colonial Groups, to illuminate the water cascading from these features. Six submersible floodlights were installed in the cantilevered basin to highlight the upper body of the fountain. Twelve submersible floodlights in the lower basin highlight the lower body of the fountain and a further forty eight radiate fingers of light through the water towards the centre of the fountain. Four beams floodlight Queen Victoria.
- Eight **CCTV cameras,** four fixed and four "pan, tilt and zoom," were installed in specific space around the fountain to enhance security. These are monitored by the GCC's central monitoring station, Streetwatch at Blochairn.



South Africa and Canada during installation on the fountain. *(Nicola Ashurst)*

(Nicola Ashurst)

There is a series of help points on Glasgow Green. Two of these are in the Doulton Fountain civic space; once activated, CCTV recording begins and the central station is able to communicate with the caller or vandals. People climbing over the outer fence surrounding the fountain activate a ground loop protection system which raises an audible alarm in the monitoring station at Streetwatch. Cameras record their activities and a tannoy system enables the monitoring officer to advise that their activities are being watched and filmed.

Regeneration of Glasgow Green has been accompanied by an interpretation plan prepared by Neil Baxter Associates which includes a family of leaflets, a book ("The Wee Green Book"), DVD, touch screen presentation, education pack and a Glasgow Green website. Park Rangers have developed a programme of guided tours around Glasgow Green which brings its uniquely important history alive.

The day to day **management and maintenance** of the fountain is undertaken by Glasgow City Council's Land and Environmental Services. It involves regular inspection, recording and reporting on the condition of the water circulation system, filters, brominator, sump pumps, ventilation and fountain performance. The road, flood lighting and feature lighting systems have been adopted by Roads and Traffic (Lighting). Legionella risk is assessed by a specialist in the Service. The CCTV system is managed under contract by Streetwatch.

7.9 Ongoing Maintenance of the Fountain

7.9.1 Retention of the Moulds

Glasgow City Council's requirement to maintain the fountain, as set out under the terms of the HLF grant funding, obliges the council to replace any damaged blocks to at least 2023. When the Ibstock Hathernware factory closed the Plaster of Paris moulds for all the blocks and sculptures were retrieved and moved to heated storage space in Glasgow.

7.9.2 Retention of Original Sculpture Pieces

The Council has also retained all pieces of original sculpture, no matter how small, including the four Water Bearers. One is on display in the Winter Garden of the People's Palace.

7.9.3 Collection of Representative Blocks

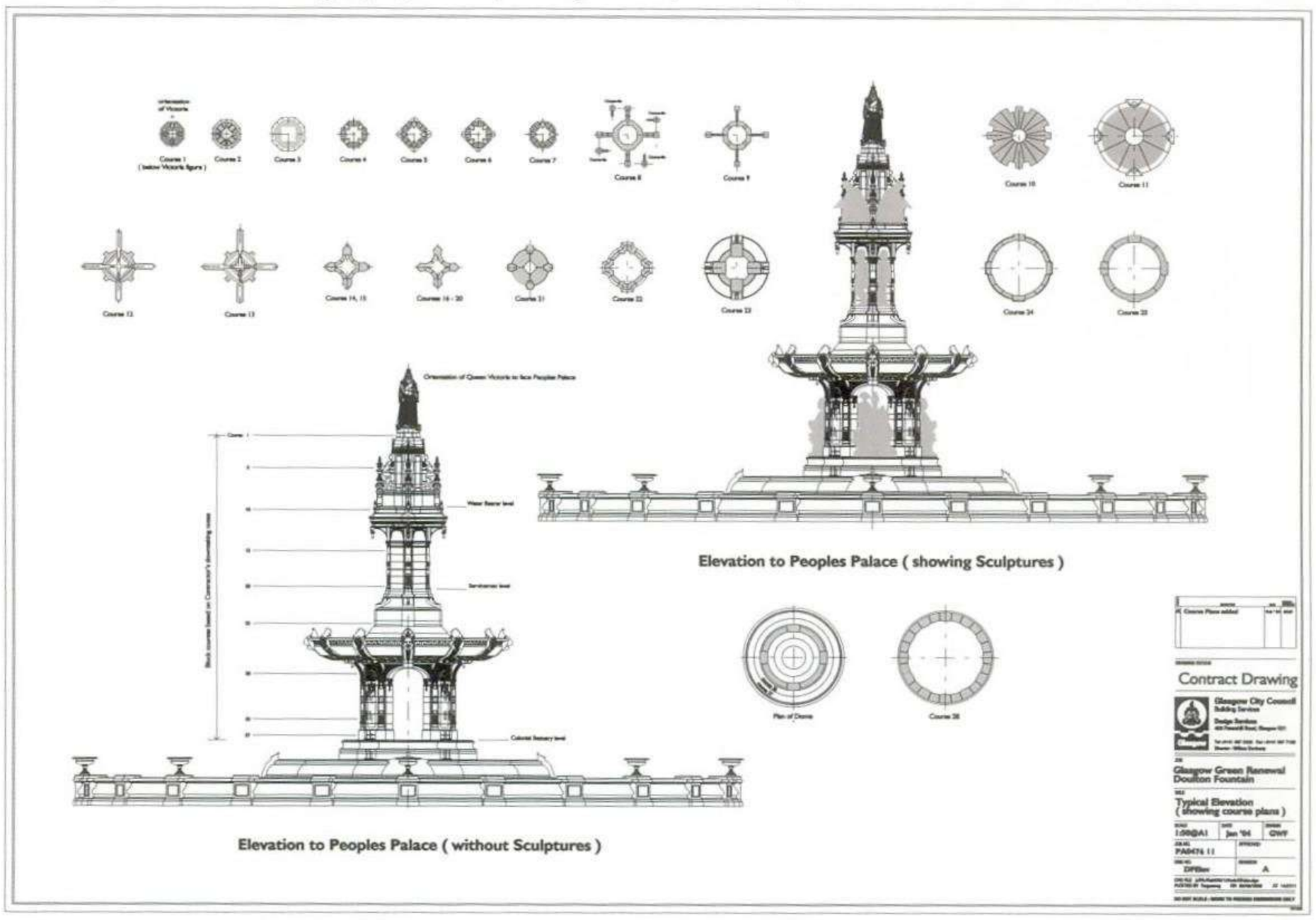
A collection representative of all block types on the fountain, which were too damaged to built back in, has also been retained.

7.10 Archives of the Studies & Works

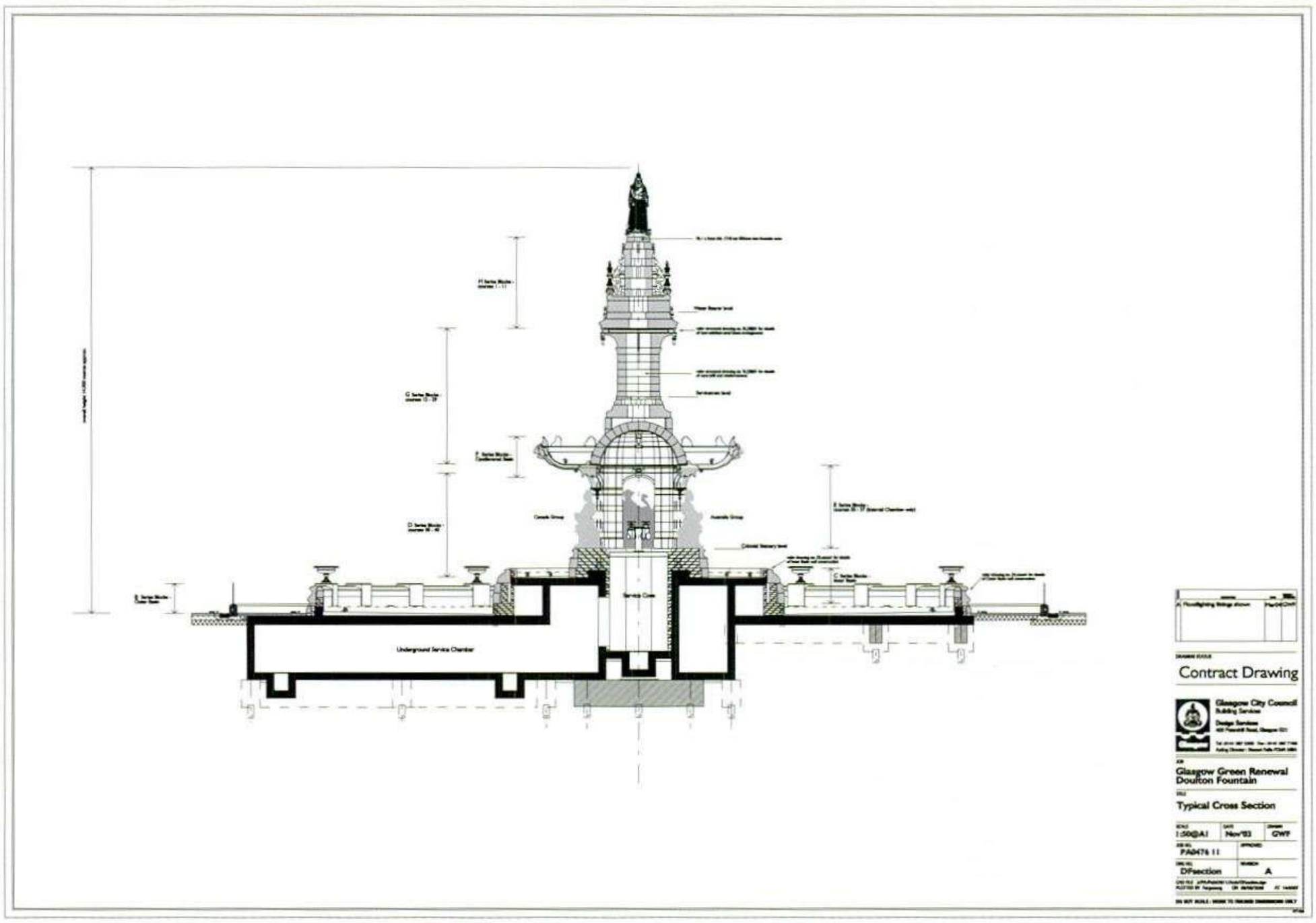
The Doulton Fountain project was thoroughly documented at all stages. An archive record of the whole project was prepared by the Project Archaeologist. Twelve boxes of records have been deposited at the Mitchell Library, Glasgow, under the following details:

Project Number: 664
Site Name: Glasgow Green: The Doulton Fountain
Site Type: Public Park - Fountain

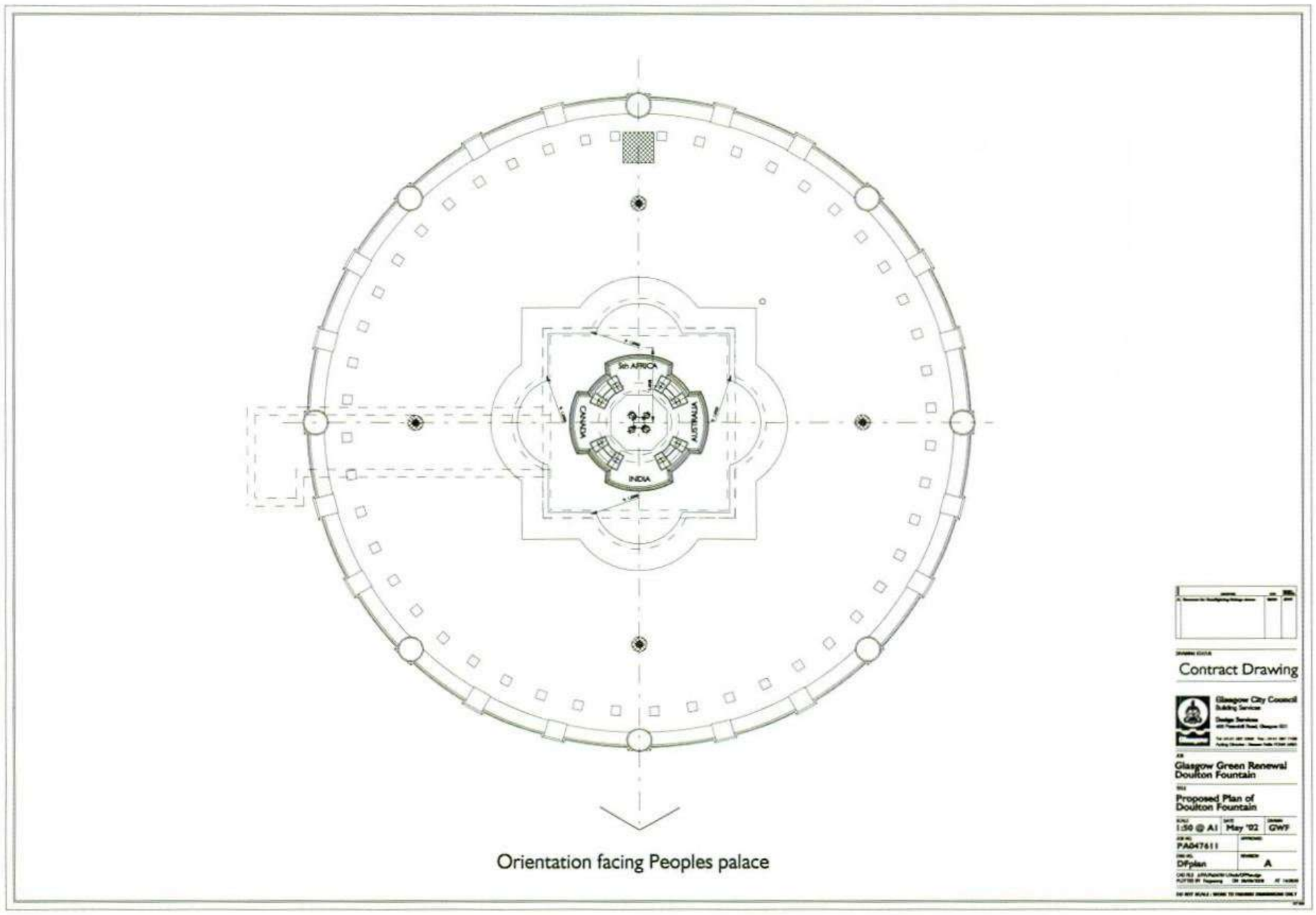
The following series of drawings, prepared by Glasgow City Council, are a record of the reconstructed fountain



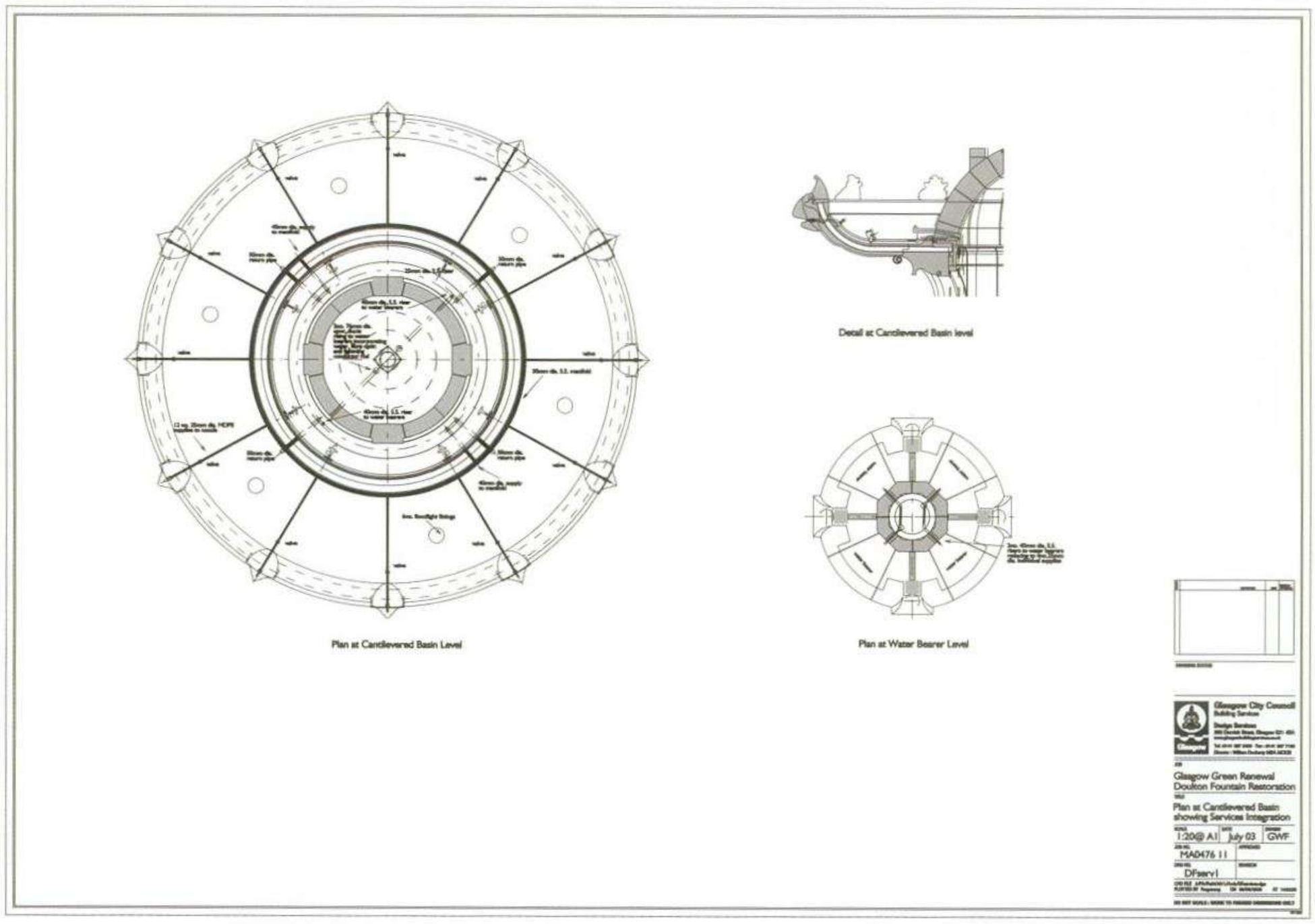
Elevations and sections through the upper courses (GCC, Building Services).



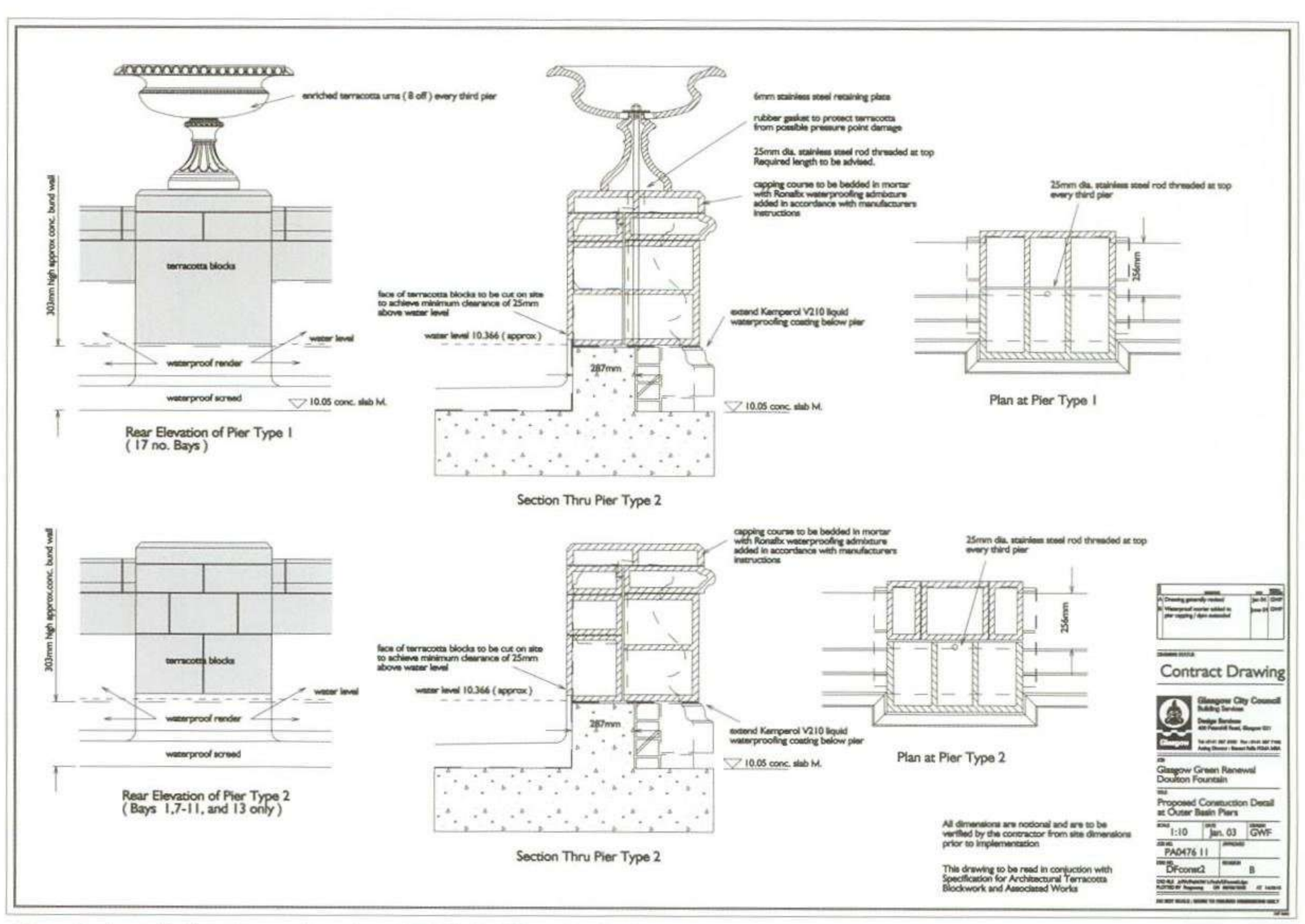
Cross section through the whole fountain (GCC, Building Services).



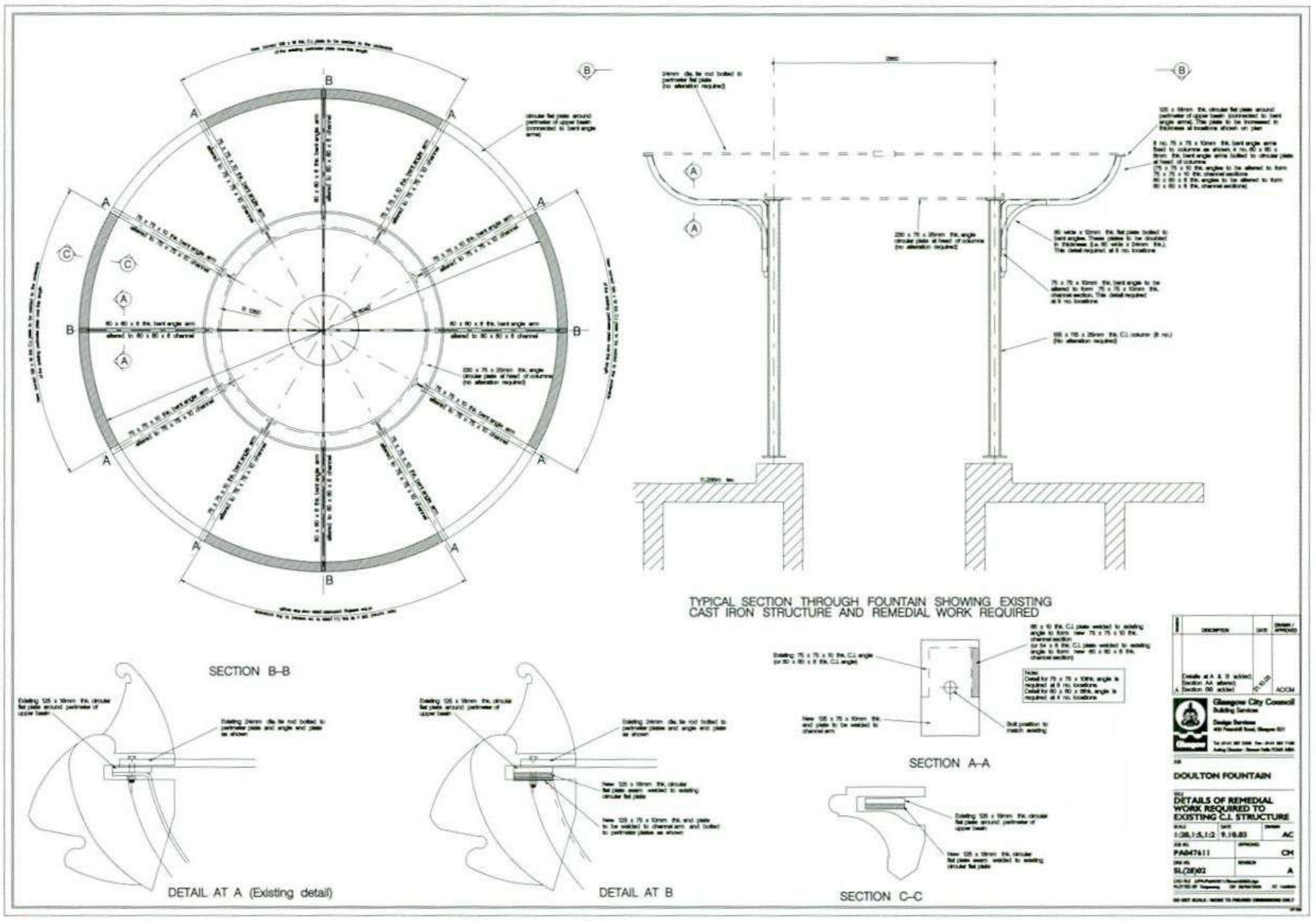
Plan at outer basin level (GCC, Building Services).



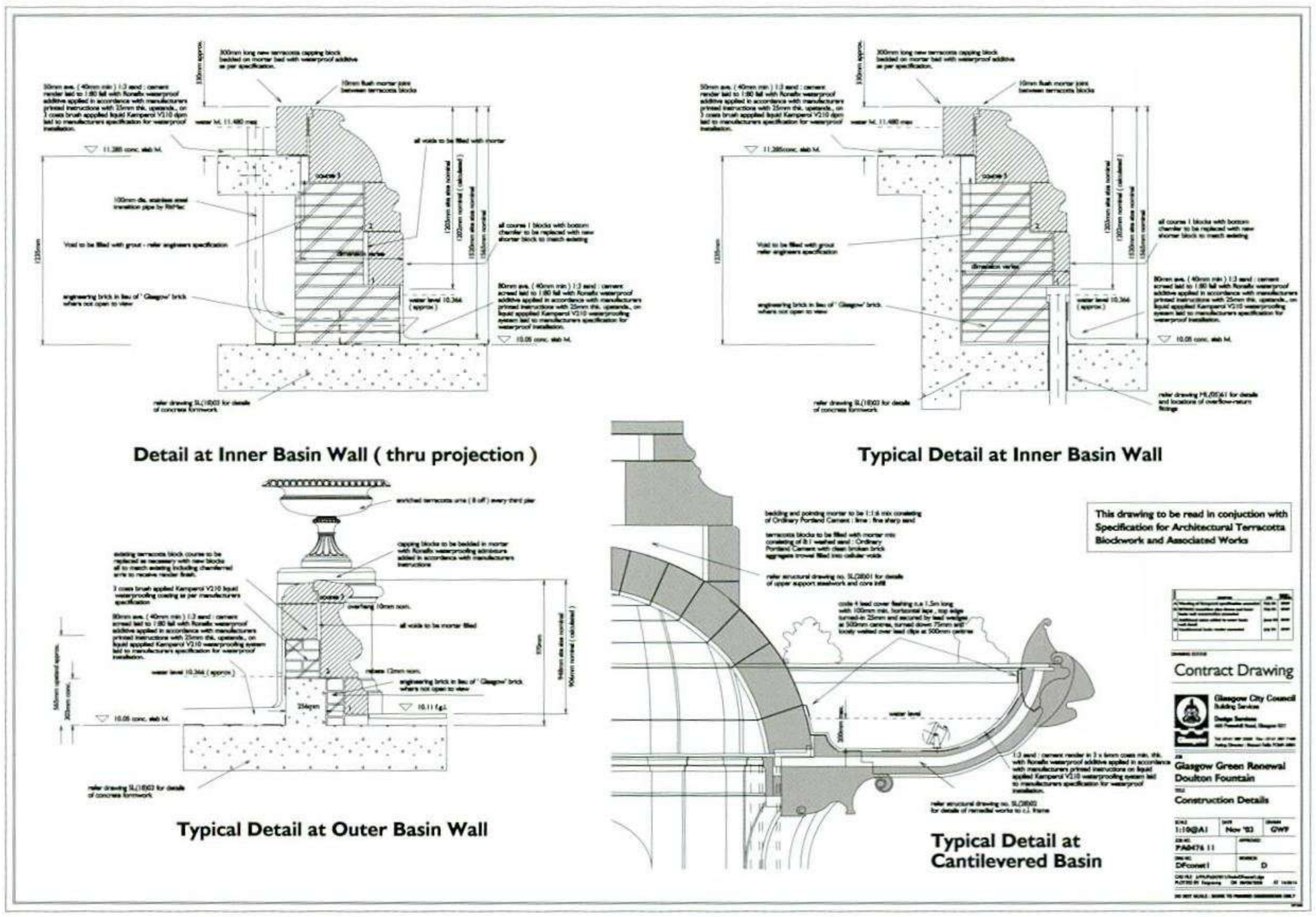
Plan and section at cantilevered basin level; plan at water bearer level (GCC, Building Services).



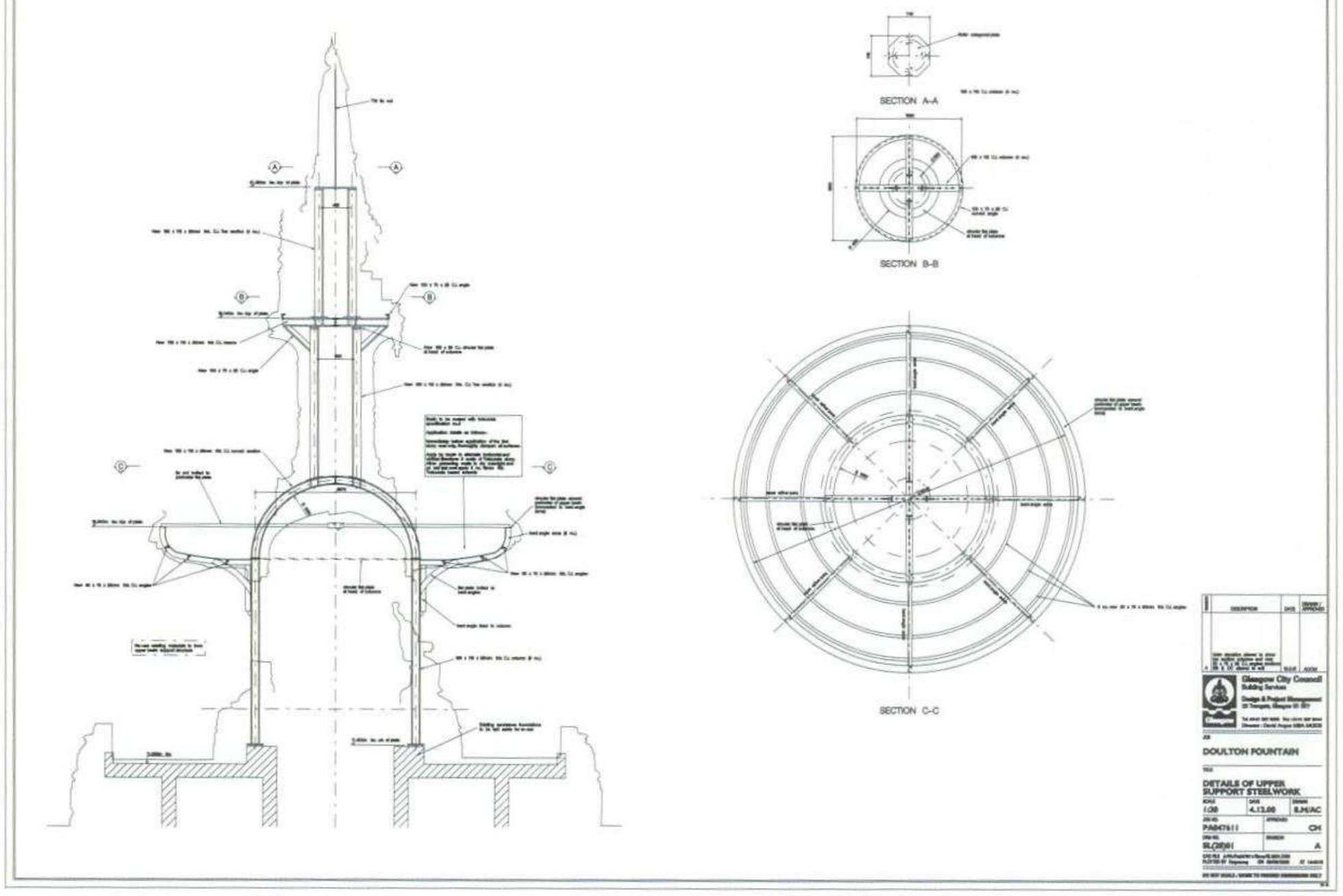
Outer basin wall elevations and sections (GCC, Building Services).



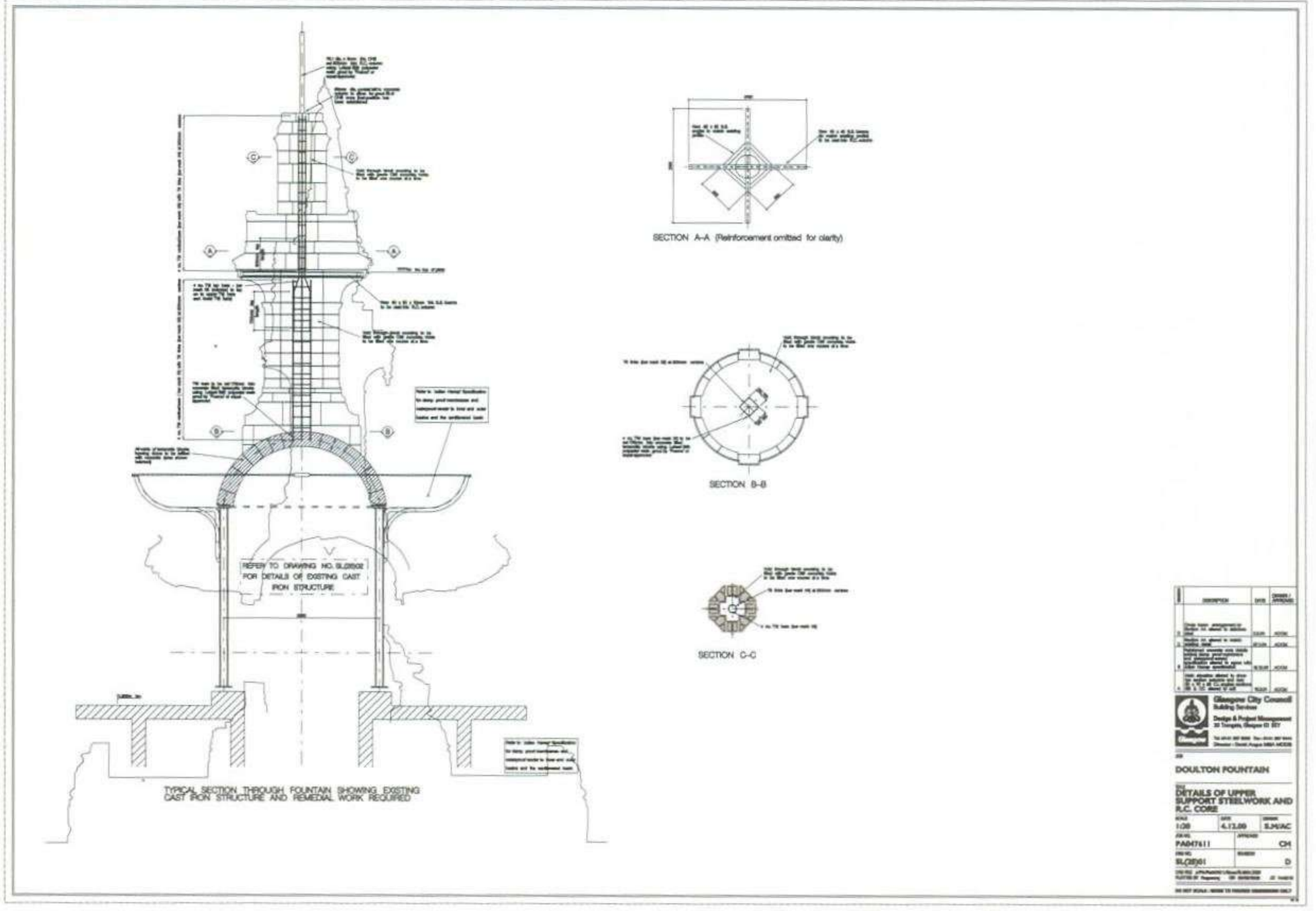
Details of the original cast iron and wrought iron support structure to the cantilevered basin (GCC, Building Services).



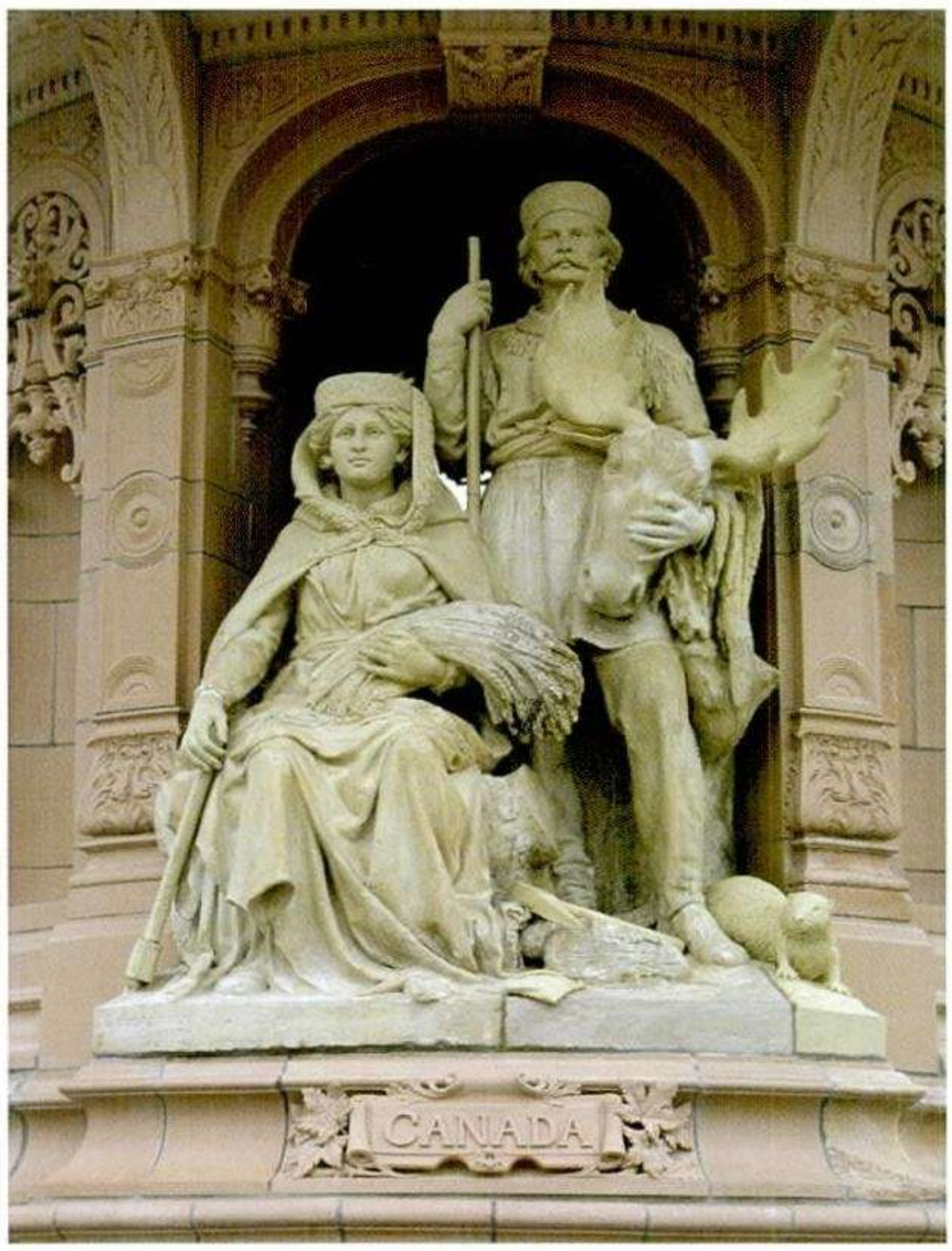
Section details at the outer basin wall, inner basin wall and cantilevered basin (GCC, Building Services).

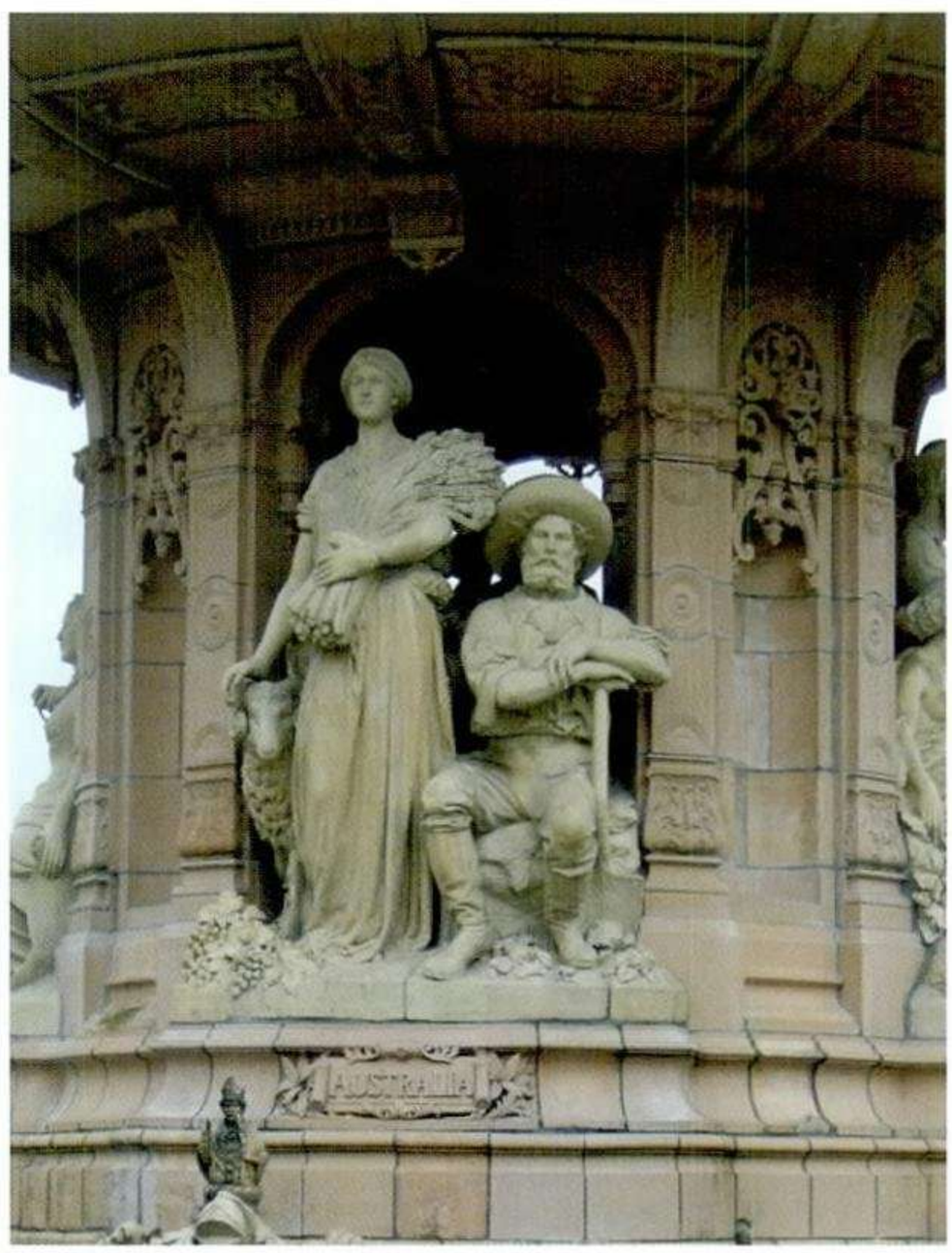


Section through the original ferrous support structure (GCC, Building Services).



The modified support structure (GCC, Building Services).





The four colonial groups, restored and conserved.

8 APPENDICES

8.1 Bibliography

GLASGOW CITY COUNCIL (LAND SERVICES):

Glasgow City Council September, 1993 Glasgow Green Renewal, The Proposed Renewal of Glasgow Green, Fleshers Haugh and Richmond Park – A Report Prepared by the Director of Parks and Recreation GCC, Glasgow. Unpublished.

Glasgow City Council May 1996 Glasgow Green Renewal Supplementary Information – Report Prepared by Glasgow City Council to Supplement Key Issues Contained Within the Full Glasgow Green Renewal Submission to the Heritage Lottery Fund (1) GCC, Glasgow. Unpublished.

Glasgow Green Renewal Supplementary Information February 1997 – Report Prepared by Glasgow City Council to Supplement Key Issues Contained Within the Full Glasgow Green Renewal Submission to the Heritage Lottery Fund (2) GCC, Glasgow. Unpublished.

GLASGOW CITY COUNCIL (BUILDING SERVICES):

Contract documents.

(THE) BRIDGEGATE TRUST LTD

(The) Bridgegate Trust Ltd. 1990 The Doulton Fountain, Glasgow Green. A Feasibility Study Prepared for Glasgow District Council Glasgow. Unpublished.

GUARD:

Evans, Caitlin; Arthur, John; Ballin Smith, Beverley; Speller, Keith and Tompsett, Gary 1999. The Doulton Fountain, Glasgow. An Archive Investigation for Glasgow City Council GUARD, Glasgow. Unpublished.

Ballin Smith, Beverley 1999 The Doulton Fountain of Glasgow. An Archive Investigation for Glasgow City Council GUARD, Glasgow. Unpublished.

JULIAN HARRAP ARCHITECTS:

The Harrap documents used at Tender stage were as follows:

Doulton Fountain Terracotta Repairs Julian Harrap Architects February 2000 (A3 format – collection of drawings identifying extent of new terracotta blockwork)

Doulton Fountain Specification for Architectural Terracotta Blockwork & Associated Works Julian Harrap Architects February 2002 (A4 format-text document)

Doulton Fountain Outline Scope of Works Julian Harrap Architects February 2002 (A4 format-text document)

ADRIEL CONSULTANCY:

Adriel Consultancy September, 1999 Photographic Record of In Situ Sculptures - Victoria and the Water Bearers. Unpublished.

Adriel Consultancy September, 1999 Photographic Record of Removed Sculptures – Soldiers and Colonial Groups. Unpublished.

Adriel Consultancy November, 1999 Preliminary Strategy for the Conservation and Repair of the Sculptures. Unpublished.

Adriel Consultancy January-March, 2003 Schedules of Block Repairs - Survey Period. Unpublished.

Adriel Consultancy August, 2000 Doulton Fountain Sculptures - Schedule of Repair and Conservation Works and Associated Illustrations. Unpublished.

Adriel Consultancy January, 2000 Doulton Fountain Glasgow Green – Schedules and Specification for the Conservation, Repair and Replacement of Terracotta Sculptures.

Part A: General Procedures and Requirements for All Works to the Sculptures.

Part B: Schedule of Repair (Conservation Works (Terracotta Conservator) and Replacement Works (Terracotta Manufacturer)).

Part C: Specification for Conservation and Repair Works to the Original Pieces of Terracotta (Terracotta Conservation).

Part D: Specification for Replacement Sculptures and Pieces of Sculptures in Kiln-fired Terracotta (Terracotta Manufacturer) January 2000 Unpublished.

Adriel Consultancy & Carthy Conservation June 2003 Doulton Fountain – Conservation of the Sculptures, Phase 1. Report on the Conservation Works. Unpublished.

CARTHY CONSERVATION

Carthy Conservation 2002 Doulton Fountain Glasgow Green Terracotta Sculptures Initial Conservation Report 4/11/02.

OTHERS:
The Architect (Supplement) September 5 1890 London

Atterbury, Paul & Irvine, Louise 1979 The Doulton Story Royal Doulton Tableware Limited, Stoke-On-Trent.

British Architect March 16, 1888 Fountain for the Glasgow Exhibition London, p.199. March 16, 1888, p.199.

Cortauld Institute Illustration Archives. General Editor: Peter Lasko. Archive 4. Late 18th & 19th Century Sculpture in the British Isles. Part 11: Glasgow. Editors: Benedict Read & Philip Ward-Jackson. Published: Harvey Miller Publishers in association with The Cortauld Institute of Art, University of London.

Davison, T Raffles 1888 Pen-and-Ink Notes at the Glasgow Exhibition London, pp15-17

McKenzie, Ray with Nisbet, Gary 2002 Public Sculpture of Glasgow (Public Sculpture of Britain, Volume 5) Liverpool University Press, Liverpool.

Reid, Melanie Victoria Victorious The Herald Magazine (Glasgow Herald), 02.10.04, pp 28-30.

8.2 The Project Team

GLASGOW CITY COUNCIL TEAM

CLIENT DEPARTMENT/S:

Land & Environmental Services:	Executive Director Robert Booth Parks, Transport and Environment Manager Kenneth Boyle Management Team Project Sponsors Brian Atkinson (retired) John Conway (retired) Ian Telford Project Manager Peter Downing
Land & Environmental Services:	Landscape Design Conservation and Ecology Arboriculture Horticulture Management Information Unit Ground Maintenance Operations Finance and Audit Health and Safety
Architectural Conservation And Design: Project design and documentation (pre construction) John Grierson: Project leader, former Architectural Conservation and Design Team, Development & Regeneration Services (formerly Building Services).	
Building Services: Gordon Ferguson: Project leader, former Architectural Conservation and Design Team, Development & Regeneration Services (formerly Building Services)	Design Implementation, Including: Contract Management Financial Monitoring Quantity Surveying Geotechnical Engineering Structural Engineering Electrical Engineering Civil Engineering Clerk of Works (Inspectorate)
Chief Executives Office:	Legal Services Central Finance Insurance.

FUNDERS:

1805 Club	Nelson's Monument	£500
Glasgow City Council	Glasgow Green (including Doulton Fountain)	£5,193,650
Historic Scotland	Nelson's Monument	£105,058
Historic Scotland	Doulton Fountain	£844,500
Heritage Lottery Fund	Glasgow Green (including Doulton Fountain)	£8,821,000
Headley Trust	Doulton Fountain	£7,500
ERDF	Glasgow Green	£883,000
TOTAL		£15,855,208

CONSULTANTS:
Project Archaeologist:

Glasgow University Archaeological Research Division (GUARD)
Gregory Building
Lilybank Gardens
The University of Glasgow
GLASGOW G12 8QQ
Tel: 0141 330 3639
Fax: 0141 330 3863

Personnel:
Beverley Ballin Smith (Project Manager)
Caitlin Evans
John Arthur
Keith Speller
Gary Tompsett

Terracotta Consultant for the Fountain Blocks, Pre-construction Phase:

Julian Harrap Architects
(Julian Harrap and Bob Sandford)
95 Kingsland Road
LONDON E2 8AG
Tel: 0207 729 5111
Fax: 0207 739 8306

Consultant for the Sculptures and the Construction Phase:
Adriel Consultancy
(Nicola Ashurst)
1/52 Sloan Street
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Tel: 0131 554 4044, 07775 696 654
Email: nicola@nicolaashurst.co.uk

Photogrammetry:
W. S. Atkins

Terracotta Analysis:
Ceram Research, Stoke-on-Trent

CONTRACTORS

Principal Contractor:
Hunter and Clark Ltd.,
Quay Road North
Rutherglen
Glasgow G73 1LD
Tel: 0141 554 2327
www.hunterandclark.co.uk

Richard Bennie, Construction Director
James Brady, Contract Manager
Jim Watson, Foreman Mason

Terracotta Manufacturer:
Ibstock Hathernware Ltd
Hathern Works
Hathernware Industrial Estate
Rempstone Road
Normanton-on-Soar
Loughborough
LEICESTERSHIRE LE12 5EW

Geoff Hollis, Commercial and Production Manager
Now at:
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Hathern Works
Hathernware Industrial Estate
Rempstone Road
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Email: geoff.hollis@ntlworld.com

Jez Ainsworth, Sculptor
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Shepshed
LEICESTERSHRE LE12 9AQ
Tel: 0792 929180

Conservator:
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Carthy Conservation Ltd
(Deborah Carthy)
18 Alexandria Road
LONDON W13 ONR
Tel: 020 8840 3294
Email: deborahcarthy@btclick.com

Management By:
Adriel Consultancy, Nicola Ashurst

Water Distribution System:
Richie MacKenzie Ltd.
(David Magill)

Lighting System & CCTV:
Weir & McQuiston

Interpretation:
Neil Baxter, Neil Baxter Associates

HISTORIC SCOTLAND

HERITAGE LOTTERY FUND

Senior Monitor	Mr Martin Tabor Land Use Consultants 37 Otago Street Glasgow G12 8JJ
Terracotta Monitor	Mr Eric Brookes 31 Plainwood Close Chichester BO19 5YB

8.3 Detailed sequence of events of the set up of the project

The sequence of events at the early stages of the project was as follows

- 1989/90. Preparation and presentation of designs for Glasgow Green in the spirit of the successful 1988 Glasgow National Garden Festival in 1990.
  Based on user survey data Council decided that the way forward was to return"The Green of Glasgow Green to the people of Glasgow."

- Proposals for the renewal of Glasgow Green, Flesher's Haugh and Richmond Park were presented to the Parks and Recreation Committee in September 1993. Unpublished.

- May 1996. Submission of an application to Heritage Lottery Fund for Glasgow Green Renewal. This document proposed restoring the section of the Doulton Fountain above the cantilevered basin only and locating it in the Winter Garden. Unpublished.

- February 1997. Supplementary information was sent to Heritage Lottery Fund including the development of proposals for the full restoration of the Doulton Fountain. Unpublished.

- May 1997. Supplementary Information No.2 was sent to Heritage Lottery. This covered full details of the Tree Replacement Management Programme, Interpretation and Revised Budget Costs. Unpublished.

- 01 Decemeber 1997. Announcement of the successful application.

Glasgow City Council (Building Services): Contract Documents.

Building Services undertook a lot of investigation work before the contract documents were prepared. This included the following:

- Atkins was commissioned to undertake Photogrammetric Surveys of the Doulton Fountain, Nelson's Monument and the James Martin Memorial Fountain and Canopy in Febrary 1999.

- The internal condition of the railway tunnel was surveyed overnight on 24 April 1999 by a Building Services Structural Engineer and Inspector.

- The proposed site of the Doulton Fountain was close to the railway tunnel. MACDATA at the Department of Civil Engineering, University of Paisley undertook a vibration survey in May 1999.

- The GCC Development and Regeneration Geotechnical Team undertook ground investigation at the proposed site of the Doulton Fountain in June 1999.

- In the summer 2001, two experts were commissioned to advise on terracotta, Adriel Consultancy (statuary) and Julian Harrup Associates (blocks). These commissions covered the pre-contract period.

- Ibstock Hathernware, terracotta manufacturers, was appointed on 10 October 2001.

- Adriel Consultancy commission was extended on 25 January 2002.

- The Tender Report for the restoration and relocation of the Doulton Fountain was approved by the Council's Policy and Resources Committee on 10 September 2002. Hunter and Clark Ltd. was appointed the main contractor.

8.4 List of Documents Lodged by GUARD with the Mitchell Library, Glasgow 2006

Project Number: 664
Site Name: Glasgow Green: The Doulton Fountain
Site Type: Public Park – Fountain

DOCUMENTARY ARCHIVE CONTENTS LIST

664	- Item 1:-	Master copy of publication drawings and photographs.
664	- Item 2:-	Correspondence regarding Doulton Fountain.
664	- Item 3:-	Video tape, discs and colour slide photography of Doulton Fountain
664	- Item 4:-	Archive research and images, feasibility study and specification reports on Doulton Fountain project.
664	- Item 5:-	Pre-reconstruction photography and negatives, correspondence, primary recording and block details on Doulton Fountain.
664	- Item 6:-	Geophysical survey of Glasgow Green.
664	- Item 7:-	Colour negative photography (large format) April 1999.
664	- Item 8:-	Black and White Negatives and Contact Prints (large format) April 1999 Colour negative photography (large format) April 1999.
664	- Item 9:-	Colour transparencies (medium format) April 1999.
664	- Item 10:-	Stereo Photography (medium format) April 1999 and photo survey report.
664	- Item 11:-	Video, DVD discs, colour slide, photogrammetric surveys.
664	- Item 12:-	Doulton fountain block measurements.

8.5 Terminology

SOURCE: Ibstock Hathernware Ltd.

Architectural Terracotta (alts: Terra-cotta, Terra cotta)- a 'body' of selected and prepared clays made plastic by the addition of water, hand pressed into moulds, dried, finished and fired in a kiln to make hard and durable. Blocks are generally of a size and shape which exceeds that of brick, e.g. 450mm long x 215 x 300 high. Used in load-bearing masonry construction. Blocks can be either ashlar, moulded, enriched or ornate. Different colours are typically earthy, e.g. red, buff, tawny, grey, etc.

Architectural Faience – all as terra-cotta but with the addition of a surface coating of ether a 'glaze' or 'engobe', typically a different colour and texture to the underbody.

Body – Clay, or blend of clays, prepared to the required consistency from which certain elements and impurities have been removed and to which selected constituents may have been added, i.e. mineral stains and metallic oxides.

Glaze – A coloured coating, either opaque or translucent, applied to clay blocks or slabs which when fired become a hard and durable finish. Glazes can be plain, mottled or textured and can range from high gloss to egg-shell finish.

Engobe – an opaque, coloured clay slip coat applied to the surface of a block or slab and fired to a hard and durable finish.

Hand pressed block – a load bearing unit, either terra-cotta or faience, formed by building clay walls approx. 35mm ($1^{1}/_{4}$") thick. Hollow cells are formed in the back of the block by the addition of strengthening webs. They can be straight, curved or circular. Blocks fall into the following categories:

- **Ashlar** – a block of rectangular shape with one or more finished faces. i.e. ashlar quoin; two faces, ashlar double quoin; three faces.
- **Moulded** – a block with a uniform linear profile along one or more faces. E.g. string, cill, cornice, etc.
- **Enriched** – an otherwise ashlar or moulded block with the addition of a simple sculpted decoration pattern. E.g. egg & dart, acanthus leaf, etc.
- **Ornate** – a block bearing a complex piece of free hand sculpture eg coats of arms, statuary, urns and vases, etc.

Extruded block – linear units of ether ashlar or moulded description machine formed by forcing clay around a shaped die. Continuous voids may also be formed in the process in the direction of extrusion 75mm thick made by either pressing, extrusion or casting, used as a cladding to a structural wall. Mechanical, non ferrous, fixings are

required to provide support and restraint. Typically units are up to 750mm long (depending upon thickness) x 300mm wide and are cut to length and height after firing.

Firing – Clay, in the blocks or slabs, are subjected to high temperature in a controlled environment kiln using gas or other fuels. Optimum firing temperatures depend on the clay and glazes used. Typically temperatures around 1200°C are achieved to make the units hard and durable. With Architectural Faience it is sometimes necessary to twice fire the units as some glazes mature at lower temperatures than the body.

Efflorescence – is the gradual migration of soluble salts, which are sometimes present in clay bodies, mortars and fill, being drawn to the surface of the block by the climatic action of wetting and drying then crystallizing and forming white deposits.

PHYSICAL PROPERTIES OF CLAY BODIES

Compressive Strength – Of the material is generally greater than 40 N/mm^2 when tested in accordance with BS 3921: 1985. Typically a strength in the range of 50-70N/mm^2 can be anticipated.

Note: the ultimate failure strength of a block should not be confused with the compressive strength of the body from which it has been made. For example an ashlar block made from a fired clay body of 75N/mm^2, 450mm long z 100mm deep x300mm high, with walls and webs of approx. 30mm thick and unfilled hollow voids when tested to destruction failed at 25N/mm^2 approx. The effect of any concrete filling in the voids is disregarded as, due to shrinkage, it can not be guaranteed to perform structurally.

Frost resistance – Due to the high temperatures and long firing cycles generally employed in the production of Architectural Terra-cotta and Faience their liability to efflorescence can generally be assumed to be 'low' to 'nil' when tested in accordance with BS 3921:1985. However certain clays together with low firing temperatures necessary to achieve required colours may cause the units to exhibit a tendency towards efflorescence. It should also be borne in mind that the presence of soluble salts in the cements, aggregates and sands used in the installation can contaminate Terracotta and Faience causing efflorescence.

Thermal Conductivity ... 0.5-0.9 Wm/0 dry (k value) 1-1.5 Wm/°c @ 5% moisture.

Fire resistance – Incombustible

Acid resistance – Not adversely affected by atmospheric pollutants. Susceptible to damage in contact with Hydrofluoric acid.

Bulk density – Generally in the range of 1900 – 2750 $hglm^3$

Water absorption – Generally in the range of 3 to 15% by volume when tested in accordance with B.S. 3921:1985.

Manufacturing Tolerances

Overall size - +1-2% in linear dimensions.

Twist – 5mm per 300mm measured across the diagonal.

Out of Square – 5mm per 300mm length.

Colour ... to be in keeping with the body or glaze sample submitted. As with all clay based products shade variations are to be expected. The range of which is dependent upon the materials used and firing temperatures required.

Surface Quality ... units are to be free of imperfections which are known to have an adverse effect on the durability of the finished product. Visual imperfections, such as pin holes, crawls, minor copper spots, etc., are permissible provided they do not detract significantly from the overall appearance of the work when inspected at normal viewing distances.

PACKING AND DELIVERY

Domestic – units are to be packed with either polystyrene or woodwool on non-returnable timber pallets and shrink wrapped. Delivery will be made by flat bed lorry, size to suit load and site conditions, with crane off-loading if requested. Carriage, packing and handling is charged extra unless otherwise stated.

Export – units are packed in timber crates with polystyrene or woodwool packing. Any import restriction on use of packing materials imposed will be taken account of. Shipping or air freight can be arranged as required which will be charged as an extra unless otherwise advised. Insurance's, taxes and local duties can be allowed for to suit customer requirements.

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