98/9

STRUCTURAL SURVEY
OF
CATHEDRAL CLOSE WALL
POTTERGATE
LINCOLN
LCW98

A P S

ARCHAEOLOGICAL
PROJECT
SERVICES

STRUCTURAL SURVEY
OF
CATHEDRAL CLOSE WALL
POTTERGATE
LINCOLN
LCW98

Undertaken for
the Dean and Chapter
Cathedral Works Department
Lincoln

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Report Compiled by
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1 SUMMARY

Archaeological Project Services was commissioned by the Dean and Chapter of Lincoln Cathedral Works department to undertake structural recording in advance of repairs to a section of the wall of the Cathedral Close adjacent to Pottergate Arch, Lincoln.

Recording of the 12.5 length of wall revealed two main phases of construction and five phases of alteration and repair. The two main phases probably date to the 13th and 14th centuries.

2. INTRODUCTION

2.1 Background

Between April 27th and May 6th 1998 structural recording was undertaken on a 12.5m section of the wall of the Cathedral Close, adjacent to Pottergate Arch, Lincoln.

The work was commissioned by Dean and Chapter of Lincoln Cathedral Works Department and carried out by Archaeological Project Services in accordance with a specification designed by Archaeological Project Services (Appendix 1). The specification was approved by Dr. Lawrence Butler, the archaeological advisor to the Dean and Chapter.

Archaeological Building Investigation and Recording is defined as '*a programme of work intended to establish the character, history, dating, form and archaeological development of a specified building, or structure or complex and its setting, including its buried components, on land or under water*' (IFA 1996).

2.2 Topogaphy and Setting

The City of Lincoln is situated 30km southwest of Gainsborough, 26km north of Sleaford (Fig. 1) and occupies the scarp slope of the gap in the Jurrasic Limestone ridge through which the River Witham flows. Local geology comprises the Jurasic lower estuarine beds and lower Lincolnshire limestone (Hodge et al, 1984)

The recorded section of the Close Wall is located on the west side of Pottergate, just to the south of Pottergate Arch, approximately 200m southeast of the east front of the cathedral on ground sloping gently down from north to south at around 175m OD (Fig 2).

2.3 Historical setting

The earliest recorded archaeological deposits within the City of Lincoln date to the later phases of the Iron Age. At the end of the 1st century AD a Roman Coloniae (town for retired soldiers) was established at Lincoln which continued as a major urban centre until the early 5th century at least. Some six to seven centuries later the line of the wall which surrounded the Roman town was incorporated into the defences of the bail (enclosed area surrounding a castle) of the Norman castle

Lincoln lost most of its urban functions during the centuries following the collapse of Roman administration in Britain. However, the city was still able to emerge as a major religious and administrative centre in the Late Saxon and medieval periods. In 1075

construction began on the cathedral which was built in the southeast corner of the bail. Construction of the first phase of the Close Wall of the cathedral was started in the late thirteenth century and completed by 1316.

3. AIMS

The requirements of the structural recording were, as detailed in the specification (Appendix 1), to establish the character, history, dating, form and development of the structure and its setting, within the townscape.

4. METHODOLOGY

The full elevation of the wall was hand drawn at 1:10 scale with all stones individually recorded using measured offsets from a line established in relation to a known height above ordnance datum. Differences in materials, texture, weathering erosion or physical damage were also recorded in addition to details of any alterations, repairs or additions to the structure.

The wall was photographed in 5m sections using both colour slide and monochrome film. General views showing the wall and its topographical setting were also photographed.

Visual inspection was undertaken to establish differences in mortar types and identify suitable locations for sampling. In addition to determining content for matching mortar to be used in renovation work, the samples should also give some indication of the relative dates of any repointing, additions or any past renovations. For the purposes of mortar matching, samples were retrieved at the point where the wall is to be renovated and from behind the face of the structure to minimize the risk of contamination from more recent pointing, renovations or alterations. Analyses of the samples was undertaken by Hirst Conservation of Laughton near Sleaford. (Appendix 11).

The removal of small shrubs rooted between a five metre section of masonry at the north end of the wall was undertaken before recording could commence.

5. DESCRIPTION

5.1 Overall Description

Recording of the wall revealed 2 main phases of construction and 5 stages of alteration and repair.

Phases for the construction and repair of the wall are listed below and described. A full list of the structural characteristics are given in Appendix 2. For the purposes of this report contexts (numbers assigned on site to stages of wall construction) have been grouped into phases).

5.2 Phase 1.

The stonework of Phase 1 extends 7.5m from the south end of the wall, and occupies just over half of the total area recorded (Fig 5). Apart from two courses of bricks at the top of the wall, the masonry from this phase reaches almost to the full height of the structure.

Phase 1 is believed to be the earliest stage of construction and takes the form of five single course of oolitic limestone blocks with average measurements of

0.70m x 0.53m, separated by double strings of much smaller roughly hewn stone of the same material. Flat broken tile fragments were used to level string courses and may have reduced the amount of mortar required.

The bonding material is a loose, light whitish brown crushed limestone mortar with inclusions of occasional charcoal flecks and crushed tile.

The larger limestone blocks were placed horizontal to their bedding planes, presumably to reduce the load factor and to minimise splitting and cracking of the stone. In some instances bedding planes have been matched in elevation between the blocks, suggesting an aesthetic consideration in the construction.

Damage to this phase of wall is mainly limited to the west edge and lower two courses which display concave recesses in the centres of the larger stones, presumably caused by weathering. However, less severe erosion was noted to much of the Phase 1 stonework.

5.3 Phase 2

The second stage of wall construction adjoins the north end of the Phase 1 masonry, extends northwards for *c* 2-3 metres before displaying a sloping and irregular join with the alterations and repairs at the north end of the wall. The construction is markedly different to Phase 1. The same oolitic limestone is used, but the large blocks of limestone are absent as are the double strings of smaller stones. The stonework of this phase was bonded by a badly fragmented, fragile light whitish brown mortar containing crushed limestone, grits and sand.

The stones are roughly hewn and regularly coursed, with average dimensions of 0.10m x 0.12m x 0.11m. The displacement of some of the stones has left voids in the wall.

5.4 Phase 3

Phase 3 construction is located near to the north end of the wall, meeting Phase 2 masonry to the south and extending almost to the northern limit of the structure. The limestone used is slightly larger than that of Phase 2, although of the same rough hewn variety. The top northwest corner of Phase 3 has bowed out of alignment and is in danger of collapsing

Occasional worn, reused ashlar pieces were identified within this phase. These are unique to Phase 3 and presumably represent reused building materials.

A very fragile and badly disintegrated, mid brown lime mortar formed the matrix between the stones of Phase 3.

5.5 Phase 4

This phase probably marks the first use of bricks in the fabric of this part of the Close Wall. On average the bricks measure 0.32m by 60mm by 0.11m and are laid in English Garden bond, with Rat Trap bond used to form the top course. The bricks are of a regular to smooth finish, and a bluish brown colour was observed on one header edge of each brick. A light yellow, hard limestone mortar was used as a bonding material. This brickwork partially underpins the masonry of Phases 2 and 3. Two courses of the same type of bricks cap the wall immediately above the Phase 1 masonry

A survey of this area of the wall conducted in 1875 by the City Surveyors Office (Fig. 6) shows a rectangular walled area attached to the east face of this section of the Close Wall. The map also shows a gap between the southeast corner of this structure and the properties to the east (Jones 1987) It is thought that the garden wall shown on the elevation (Fig. 5) is the surviving southern wall of this structure. This walled area is likely to represent a yard or garden area linked to the properties on the west side of the Close Wall. The bricks are of the same type and bond as those of Phase 3 and it is likely that the two are of a similar date. Therefore, the section of the Close Wall located north of the current garden wall once formed the west side of the enclosed area shown on the 1875 map.

Following the demolition of the east and north sides of this structure, the remaining southern wall was extended eastward to close the gap with the adjoining properties. The extension has a slightly different alignment, a change noted during the recording of the Close Wall.

5.6 Phase 5

This area of brickwork is laid over the top of Phase 3 and forms the upper 1m of a 5m section at the north end of the wall. The bricks are laid in stretcher bond and within a matrix of hard, light yellow crushed limestone mortar containing grits with occasional tile and charcoal flecks.

Similar brickwork is located at the south end of the wall, amongst stonework used in the construction of the building which adjoins the west face of the wall. Presumably these additions to the wall fabric are of similar date. One of the larger blocks from Phase 1 was reinserted vertically into the fabric of the latter repair.

To accommodate a window inserted into the top central area of the wall, material had to be removed from three courses of the original, Phase 1 fabric. The frame is set on 12 blue bullnose headed bricks. Following the insertion of the window frame, the damage to the original fabric was repaired using small limestone fragments. Although the present window is modern, an oak lintel over the top of the frame may represent the remains of an earlier window.

All of the Phase 5 brickwork is related to the buildings adjoining the west face of the wall.

5.7 Phase 6

Two irregular areas of randomly coursed oolitic limestone at the north end of the wall represent areas where stonework has been replaced following the insertion of cast iron ventilation grills connected with properties on the west side of the wall.

5.8 Phase 7

Following demolition and alterations to various buildings on Pottergate to accommodate traffic passing the south side of Pottergate Arch, a new property boundary wall was built during the late 19th century. This wall served to delineate new property boundaries and extends in a southwest to northeast direction from the northern limit of the recorded section of the Close Wall. The

brickwork of this wall can be seen at the northern extremity of figure 4.

6. DISCUSSION

In 1285, very soon after the east end of the cathedral was completed, the Dean and Chapter complained "that they could not pass from their houses to the church without being attacked " As a result, a licence was granted by the king (Edward 1) to enclose the precinct of their church with a 12ft high wall. The wall was to be provided with "sufficient gates and locks which could be secured at dusk and opened shortly before sunrise"(Hill 1990).

On the 1st of September 1315 a confirmation of the original grant of 1285, and various other charters of land, were obtained by the Dean and Chapter. A license was then granted on the 21st of February 1316 to extend the wall eastward for further security, and to provide a larger garden for the chancery with adjoining houses.

In 1318 a further license was granted to raise the whole of the wall beyond the height of 12ft and to built turrets and crenellate the wall. This was completed by 1327.

It is likely that the Phase 1 masonry relates to the original construction of the wall which was completed by 1316 (Fig 3). The alteration of 1316 was a substantial undertaking affecting not only the original direction of the boundary wall but possibly that of the street layout (*ibid*). The neatness and steepness of the joint between Phases 1 and 2 suggest that this alteration was undertaken in a single stage during a phase of insertion or reconstruction rather than repair. It is possible that the Phase 2 stonework is associated with this stage of construction when the wall was extended eastward and Pottergate Arch is likely to have been added. Analyses of the mortar samples taken from between the stonework of these two phases show little difference in composition. Although mortar composition does not necessarily show significant changes through time, the similarity of the material from Phases 1 and 2 could be taken as evidence for a close date of construction.

A sketch of the Pottergate Arch by S. H. Grimm *c* 1784 (Fig. 7) shows the altered Close Wall. The stonework shown on the south side of the arch in this drawing is very similar to that of Phase 2.

Phase 3 probably represents a repair to the fabric of the wall, although the size of the stones is different to those used in the earlier phases, indicating that the existing, fallen masonry was not re-used. This might suggest that some time had elapsed between the damage and the repair. This is the only phase when worn ashlar blocks were used, presumably taken from damaged or demolished buildings within the city.

The Phase 4 brickwork underlying the Phase 3 masonry is likely to represent an attempt to underpin the wall. The size of these hand made and clamp fired bricks suggests an 18th – 19th century date. This indicates that the stonework of Phase 3 is of some antiquity. The present garden wall at the site is probably the remaining southern end of the rectangular enclosed garden or yard shown on the 1875 map. This wall is included in Phase 4 on the basis of the brickwork, the character of which is of 18th – 19th century in date.

However this yard or garden was probably contemporary with the buildings on the west side of the wall which are represented by the Phase 5 brickwork and also appear on the 1875 map. The bricks from Phase 5 differ to those used in the earlier phase and are likely to be later Victorian in date.

The Phase 7 brickwork, which can be seen at the extreme north end of the wall, was probably added sometime after Pottergate was remodeled to allow increased traffic access south of Pottergate Arch.

7. CONCLUSION

The recording of this part of the Lincoln Cathedral Close Wall has revealed a long sequence of construction, repair and maintenance, ranging in date from the 13th to 19th century.

It is possible that this part of the wall is the only area where the two major thirteenth to fourteenth century phases of wall construction can still be seen in conjunction. Some of the large blocks of limestone in the lower courses of Phase 1 display erosion from weathering, probably from rainwash off the tiled roof of the adjoining brick building.

8. ACKNOWLEDGEMENTS

Archaeological Project Services would like to acknowledge the assistance of the Dean and Chapter of Lincoln Cathedral who commissioned the investigation and post excavation analyses. The work was coordinated and edited by Dale Trimble. Samples of mortar were analysed by Paul D'Armada of Hirst Conservation, Laughton, Lincs. Clive Davies gave valuable information on brickwork.

9 PERSONNEL.

Project Officer: Dale Trimble
CAD illustrations: Sue Unsworth
Post Excavation Analysis: René Mouraille
Illusration: René Mouraille and Susan Unsworth
Field Recording: René Mouraille and Neil Herbert.

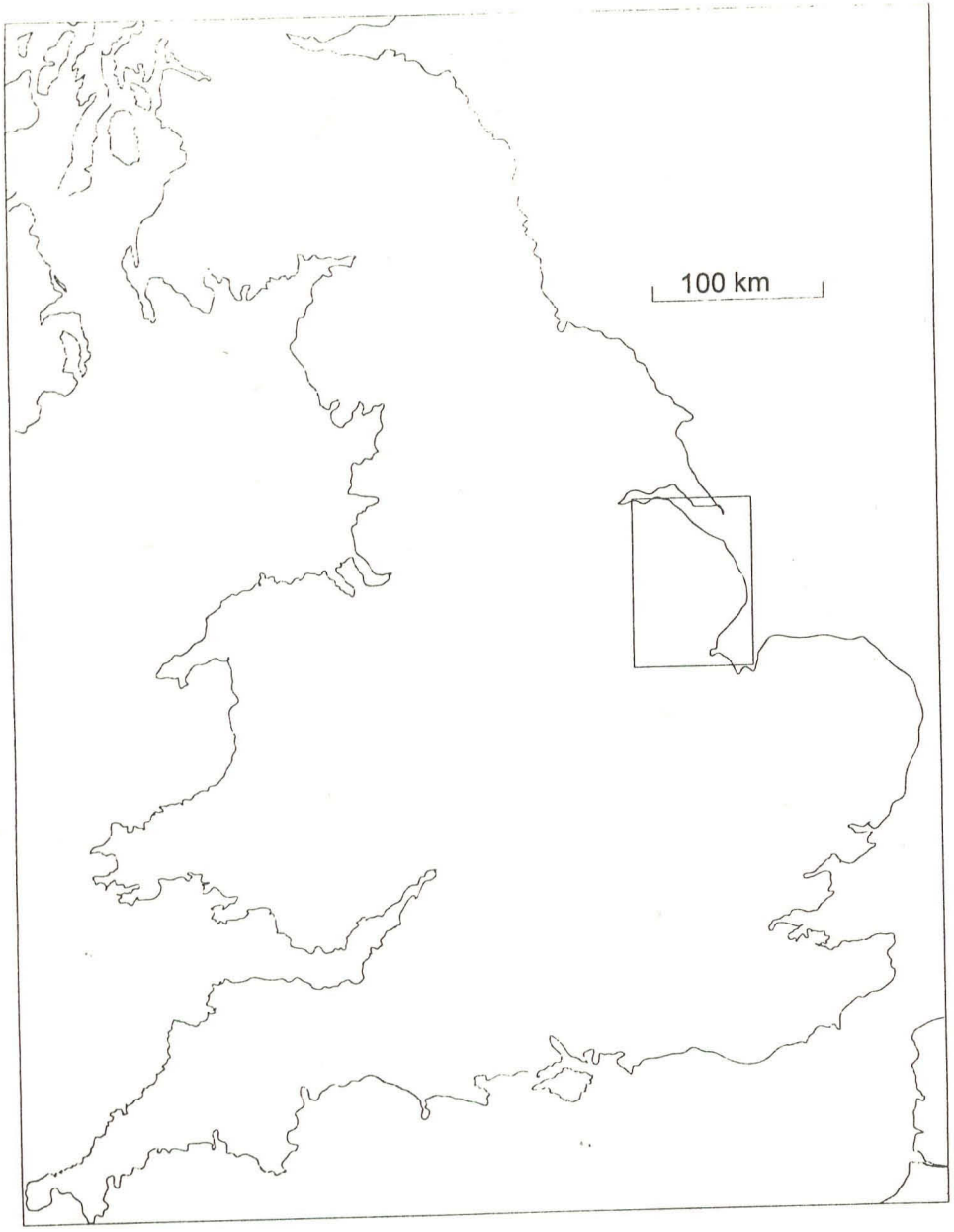
10 BIBLIOGRAPHY

Hill, Sir Francis, 1990 *Medieval Lincoln*

Institute of Field Archaeologists, 1996 *Standard and guidance for the Archaeological Investigation and Recording of Standing Buildings or Structures.*

Jones, S., 1987 in Major, K. and Varley. J. A. (eds.), *A survey of Ancient Houses in Lincoln II, Houses to the South and South and West of the Minster*. Lincoln Civic Trust

Hodge, C.A.H, Burton R.G.O, Corbett W.H. Evans R, Seale R.S. 1984 *Soil Survey of England and Wales Bulletin No 13. Soils and their use in Eastern England.*



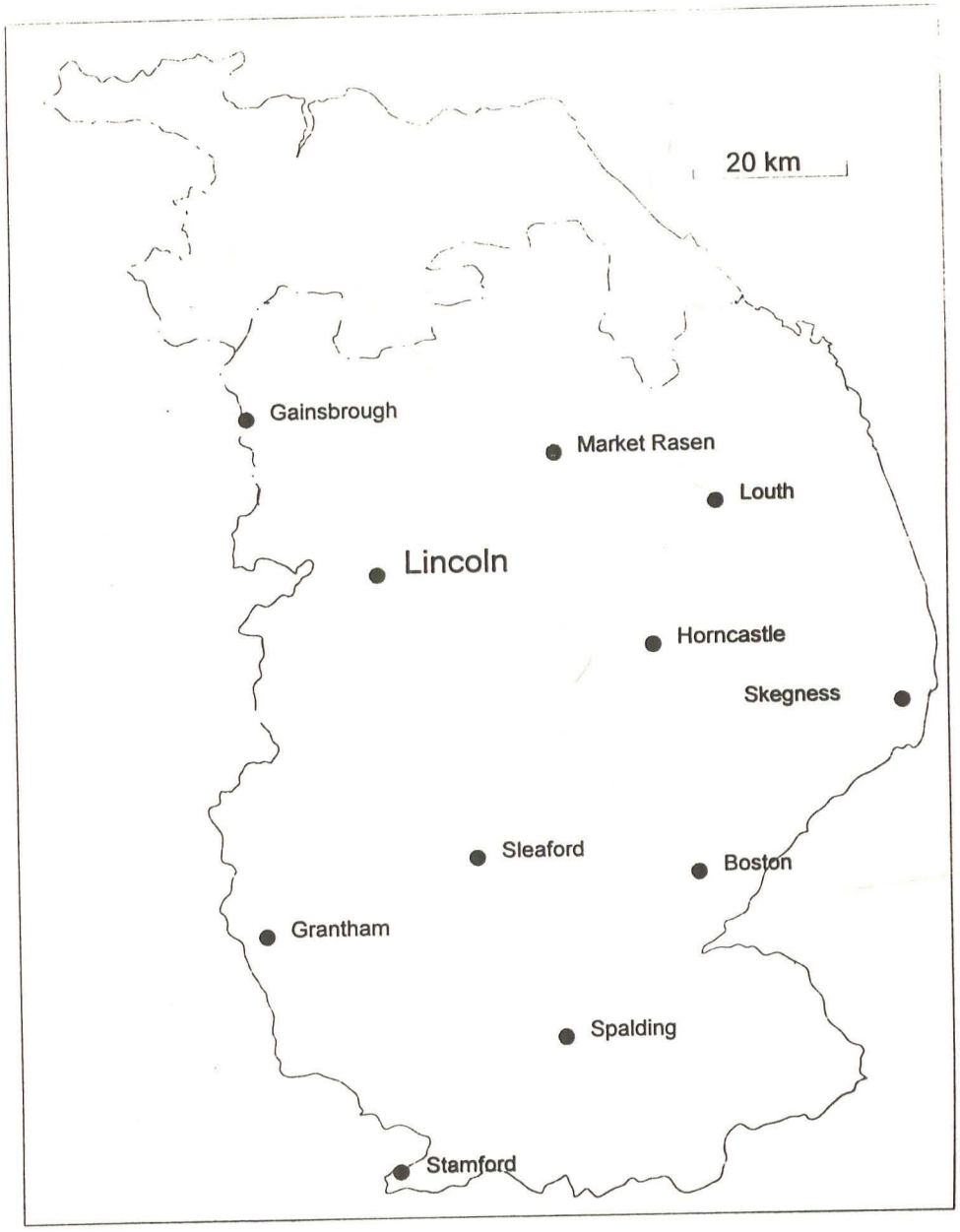


Figure 1 General Location Map

Figure 2 Site Location

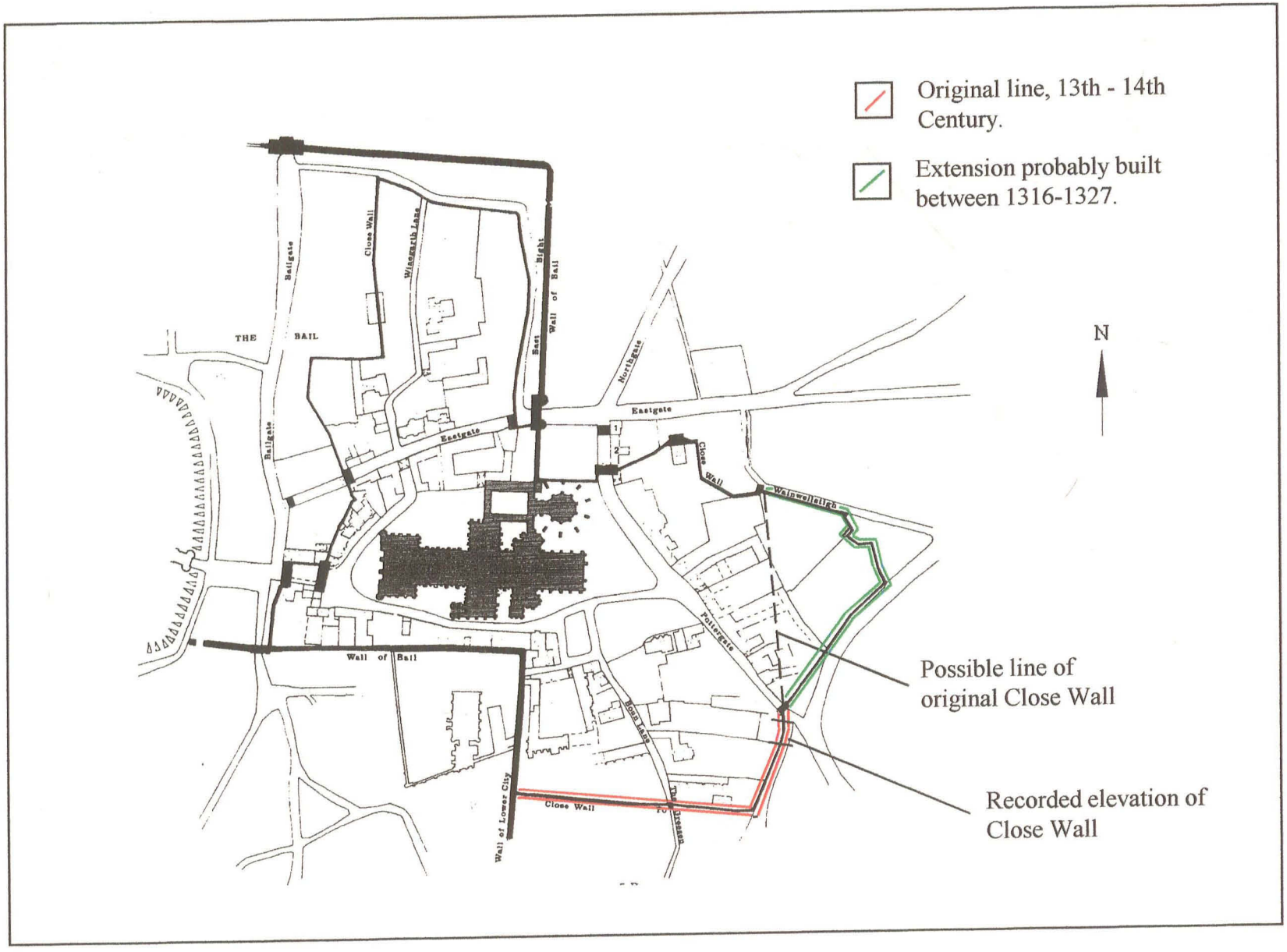


Figure 3 Location of Close Wall within precinct of Cathedral

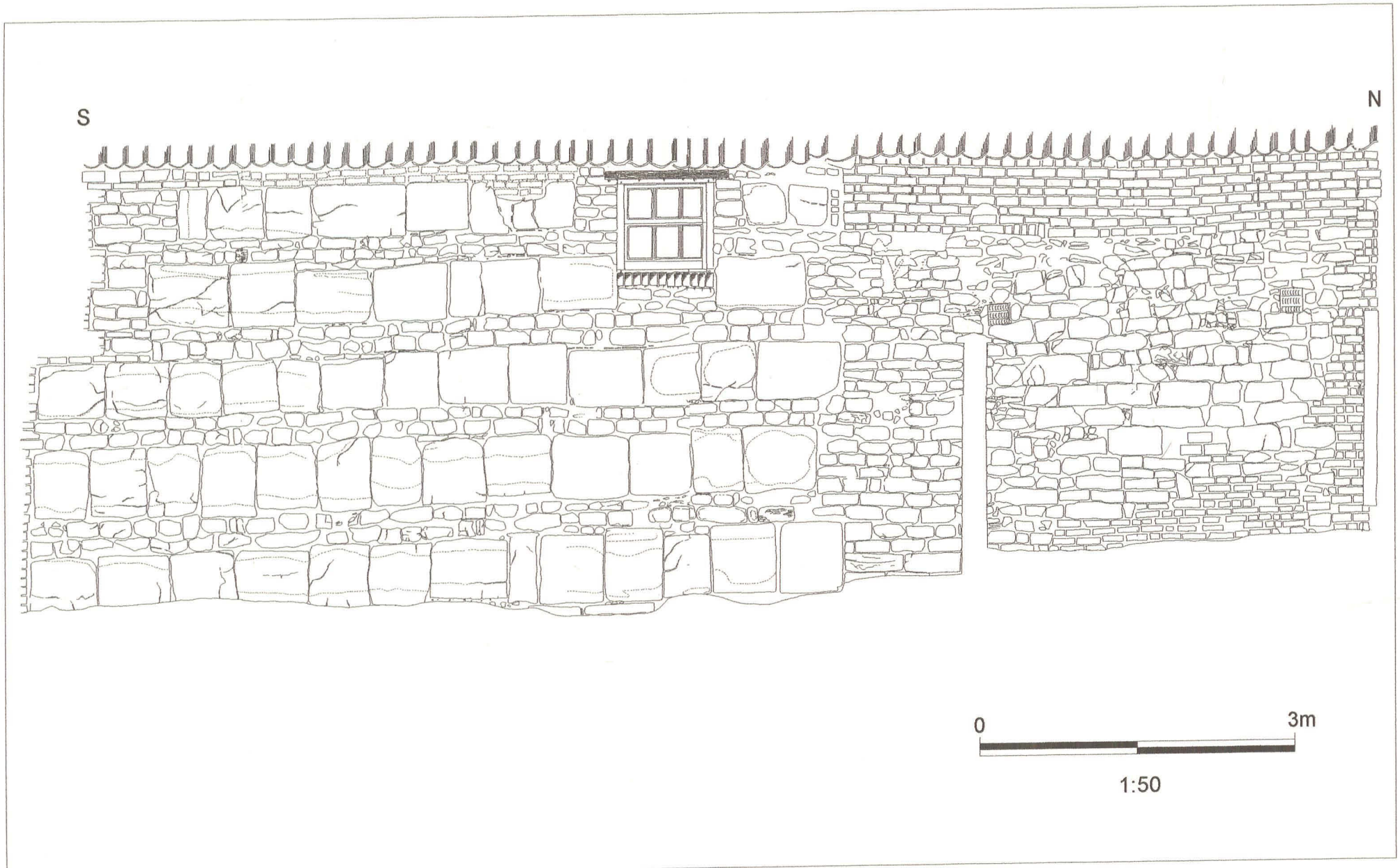


Figure 4 East facing elevation of the Cathedral Close Wall, Pottergate.

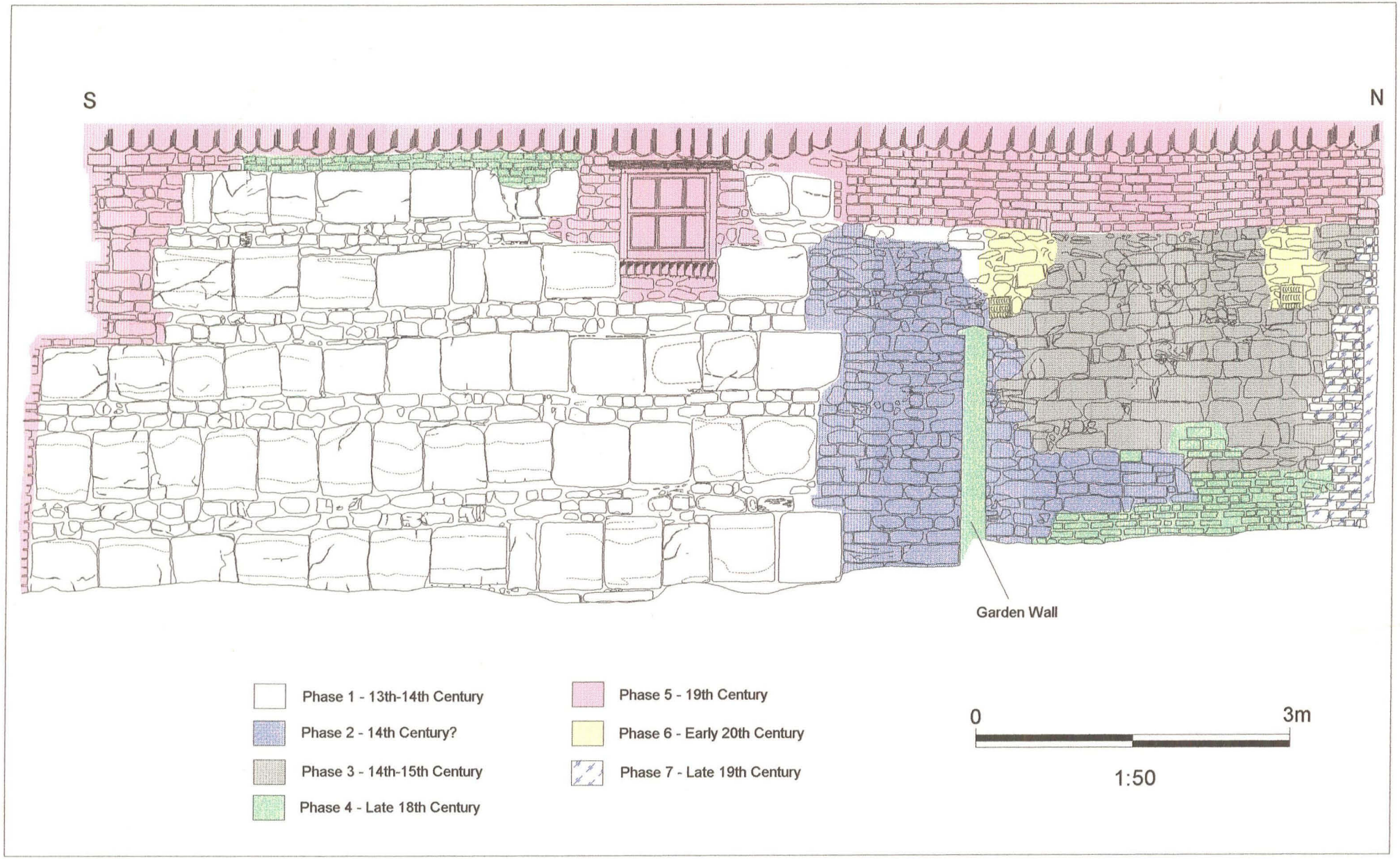


Figure 5 East facing elevation of the Cathedral Close Wall, Pottergate.
Main phases of construction.

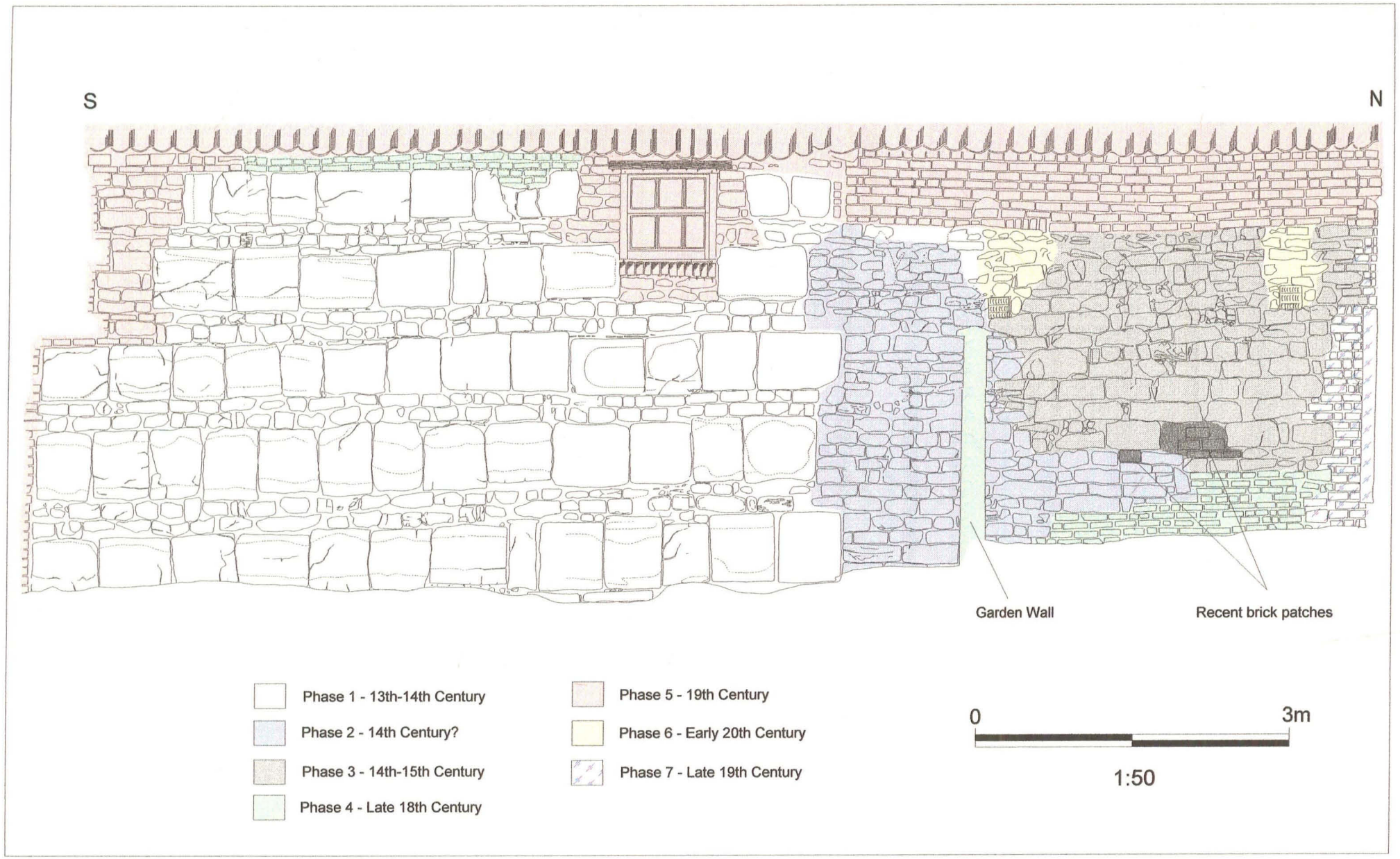


Figure 5 East facing elevation of the Cathedral Close Wall, Pottergate.
Main phases of construction.

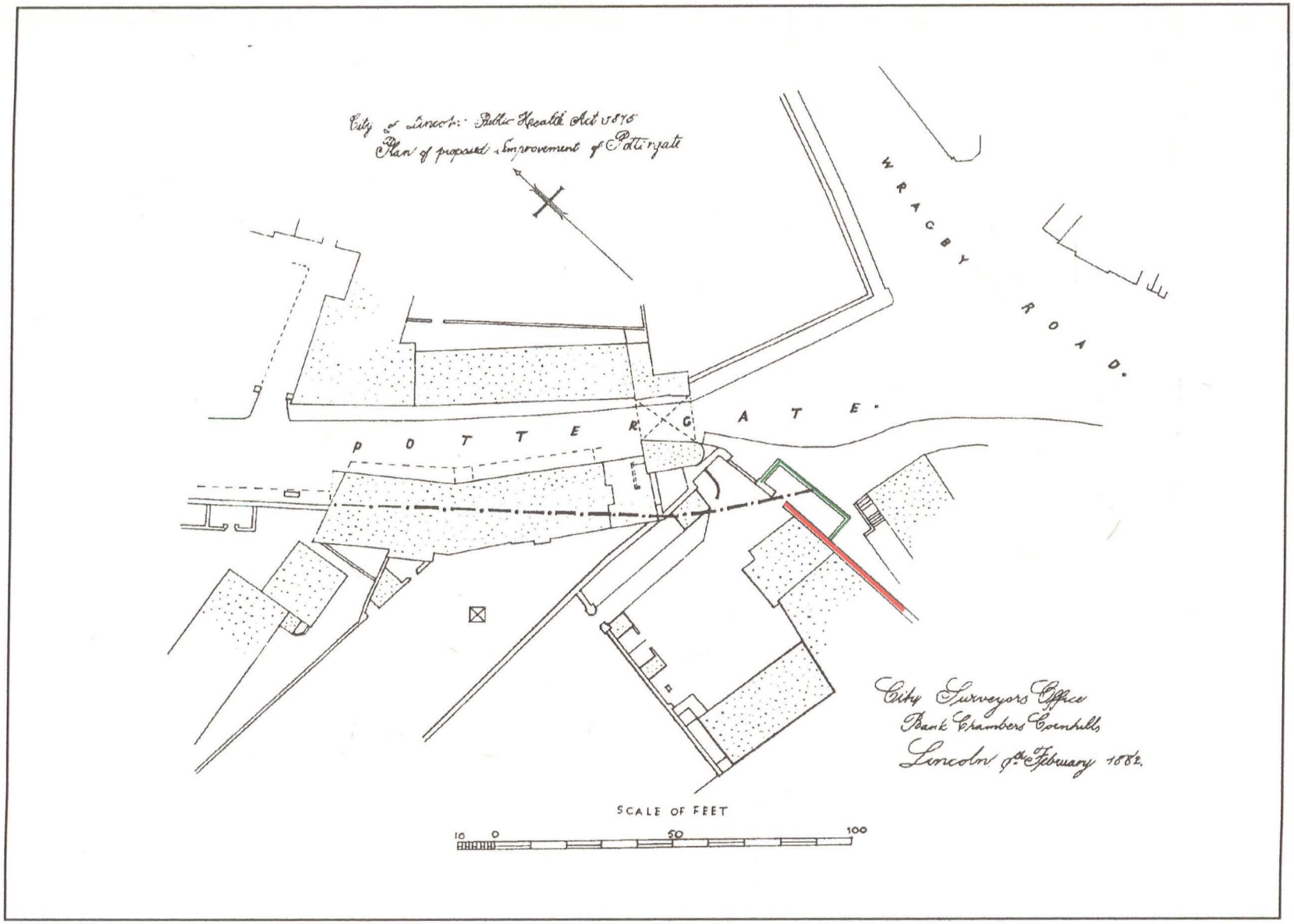


Figure 6 1875 plan showing Pottergate before road widening.
Note walled yard/garden (marked in green) attached to east side of Close Wall (drawn section marked in red).

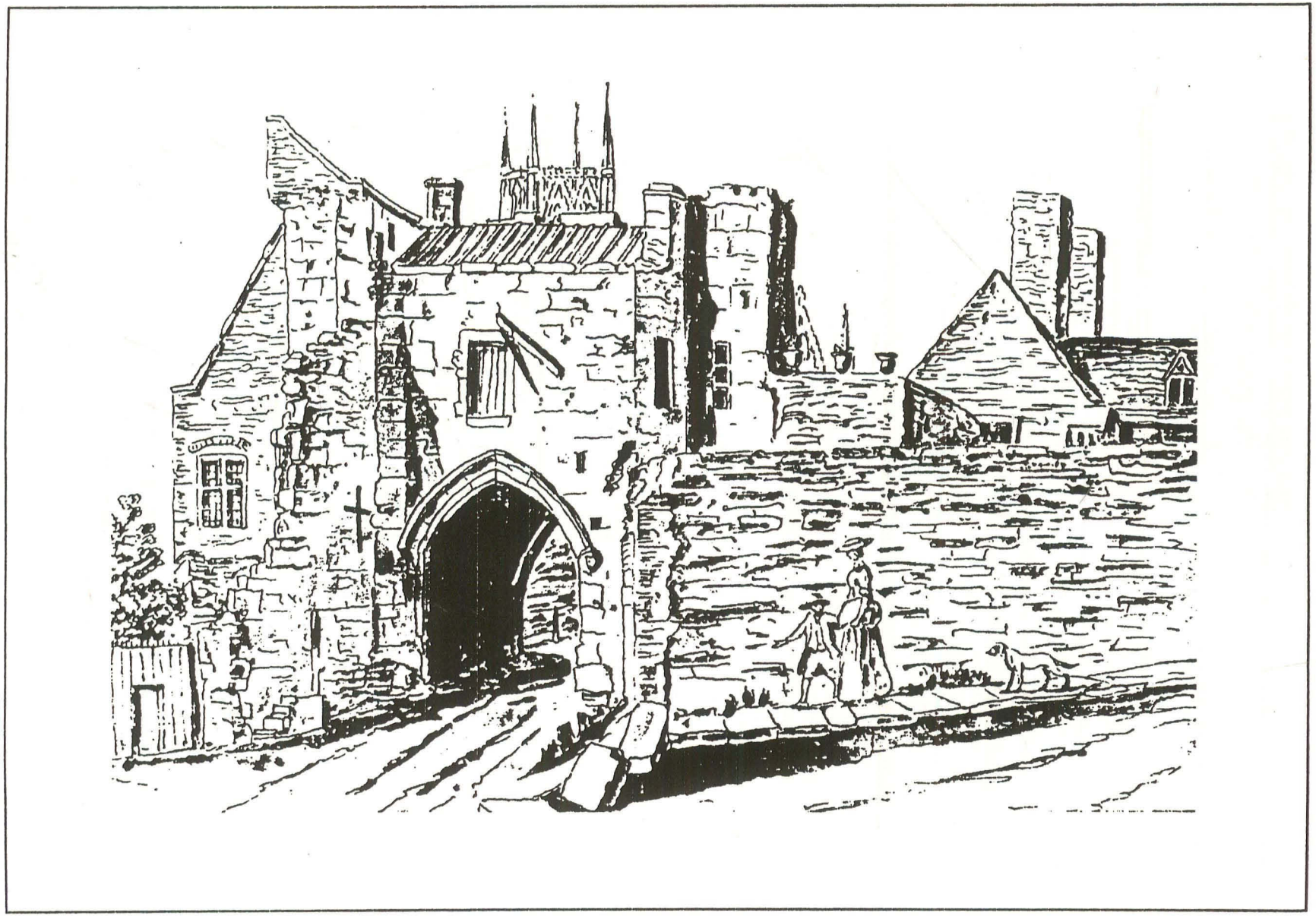


Figure 7 Drawing of Pottergate Arch by S.H.Grim c.1784

Plate 1 East Facing Elevation. Phase 1 and 2, from northeast.

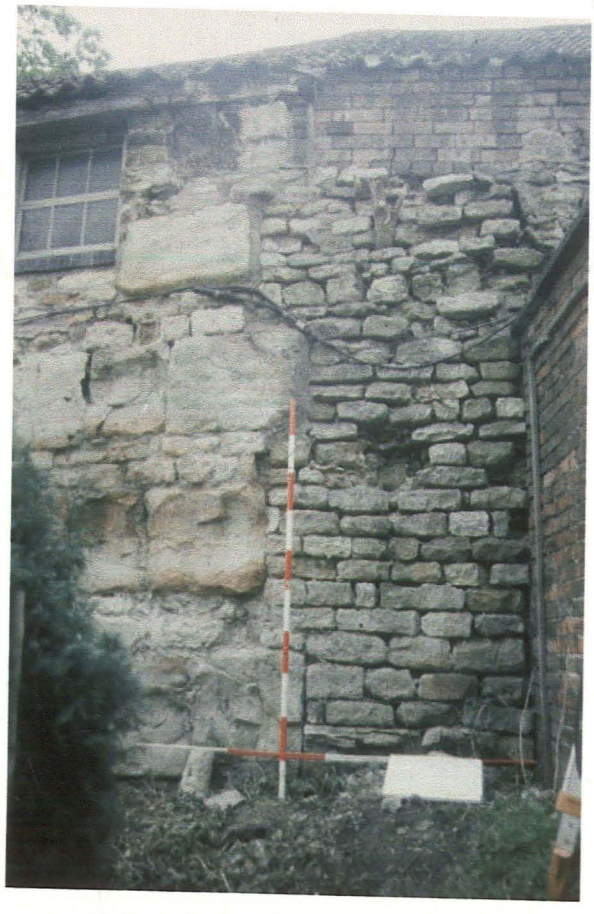


Plate 2 Phase 1 and 2, from east.

Plate 3 Phase 3, (repair adjacent to Phase 2) from east.

APPENDIX 1

Specification for recording the Cathedral Close Wall, Pottergate, Lincoln

Background

A small section of the Cathedral Close Wall immediately south of Pottergate and adjacent to the Pottergate Arch, Lincoln has been declared unsafe and now requires renovation. As part of this project some archaeological recording is required prior to and during the work. The line of the wall extends southwest from Pottergate for some 15m as standing masonry and is continued for a short distance by a much more recent brick built structure.

Renovation will involve demolition and rebuilding of the upper areas of the wall immediately adjacent to Pottergate. Visual inspection suggests that this stretch of the close wall is relatively undisturbed, due, perhaps, to a relatively secluded location. This being the case recording of the wall is of some importance and it is recommended that the full stretch of the wall is recorded up to where the masonry has been replaced by the later brickwork. An archaeologist will also need to be present during the demolition of any unsound masonry to record any features of historical interest which may be uncovered.

Methodology

The full elevation of the wall will be hand drawn at 1:50 scale with all stones individually measured. This will be done using measured offsets from a datum established in relation to a known height above Ordnance Datum. Appropriate annotations and conventions to represent differences in materials, texture, weathering, corrosion or physical damage will be included as part of the drawing. In addition notes will be taken detailing observations of any alterations, repairs or additions to the structure.

The wall will also be photographed in 5m sections using both colour slide and

monochrome film. In addition general shots showing the wall in its topographic setting will be taken

Visual inspection to establish differences in mortar type will establish suitable locations for sampling. In addition to determining content for matching mortar to be used in renovation work, the samples should also give some indication of the relative dates of any repointing, additions or past renovations. For the purposes of mortar matching, samples should be retrieved at the point where the wall is to be renovated and from behind the face of the structure to minimise the risk of contamination from more recent repointing, renovations or alterations. Sampling will be undertaken by Hirst Conservation of Laughton near Sleaford.

Reporting Requirements

Subsequent to completion of on site recording, drawings will be digistised for final editing and manipulation within a CAD system. A final report will be prepared which will contain a finished drawing and basic interpretative comments on the structure of the wall as well as descriptions of any additions, repairs or insertions into the fabric of the Close Wall. Results of the analysis of mortar samples will also be included in the report.

APPENDIX 2. CONTEXT SUMMARY

CONTEXT NUMBER	PHASE	DESCRIPTION	INTERPRETATION
001	1	Wall consisting of large blocks of oolitic limestone, with string courses of smaller limestone material	13th-14th century Cathedral Close Wall
002	2	Rebuild of wall using smaller fragments of limestone. Mortar within joints is badly fragmented	14th Century Close Wall, built to accommodate back gardens to Chancery and nearby properties.
003	4	Bricks filling gaps from weathering at the base of Phases 2 & 3	late 18th century brick repair to stabilise 002
004	4	Brick wall linking the Close Wall and Property to the south	late 18th century Property wall
005	5	Brick and stone repair to south edge of 001	Late 19th century repair to Close Wall
006	4	Double course of 18th-19th century bricks above Phase 1	Late 18th century modification using bricks as a levelling layer at the top of 001
007	5	Single string of blue bullnosed bricks supporting window.	19th century window frame associated with buildings on west side of Close Wall
008	6	The removal and replacement of stonework to 003 following the installation of cast iron ventilation grills	Early 20th century Vents
009	7	Late 19th century brickwork to the extreme north of the recorded Close Wall. Constructed to delineate new property boundaries following alterations to Pottergate	Late 19th century property demarcation wall
010	5	Later 19th century bricks above Phase 3	Late 19th century brick addition to heighten phases.2,3 & 6.
011	3	Limestone repair using various materials including redistributed ashlar.	Crude repair to phase 2

APPENDIX 3

MORTAR ANALYSIS

by Hirst Conservation

Mortar Analysis from Cathedral Close Wall

I enclose the analysis of 4 of the LCW98 samples. There are 3 more 1 would like to do. ic. Samples 15,14 and 13. I will forward the analysis to you once they have been completed.

LCW98 – Sample 9

Observations

A light cream/buff coloured, fairly hard, fine-medium grained mortar.

Carbon dioxide emission tests give a nix ratio of.

1.8	:	1
lime		aggregate

with an hydraulicity of 0.3, indication a feeble to moderate hydraulic lime. However, fragments of cream coloured sandy limestone suggest a crushed stone dust was part of' the aggregate, this will have dissolved in acid and analysed as lime. It is possible that much of the aggregate. (perhaps 50%), was crushed stone dust giving a revised mix ratio of:

1	:	1	:	1
lime		stone dust		sand

ie.

1	:	2
lime		aggregate

Carbon dioxide emission tests give a mix ratio of:

1.2	:	1
aggregate		lime

with a hydraulicity of 0.2 (feebly hydraulic). The lime is non-magnesian.

On drying the mortar looks similar in colour and texture to sample 9, as does the dried aggregate generally. Again given the probable addition of crushed limestone dust in the aggregate, this would give a revised mix ratio of:

2	:	1
aggregate		lime

which is a much more likely mix ratio

Aggregate Mode

Sieve size	% retained on sieve	Characteristics
1.18 mm	4.1%	Angular/sub rounded clear/rose/black/white quartz grains with some brick dust, sandstone fragments and charcoal
0.85 mm	4.1%	As Above
0.5 mm	26%	Angular/sub-rounded mainly clear quartz grains, with red brick dust and charcoal
0.3 mm	36%	As above, but rounded/sub-angular
0.15 mm	20.5%	As above, together with some magnetic black iron-oxide material (slag material?)
<0.15 mm	9.3%	As above, but angular/sub rounded

The aggregate is generally finer than sample 9, but otherwise is similar. The finer fraction is the same colour as that of sample 9. However, sample 9 has a greater proportion of darker, coarser fraction, but no magnetic material was found in sample 9.

Objectively samples 9 and 12 could be the same mortar, given the relatively small samples analysed, which may be unrepresentative of the greater mix, showing slight local variations.

LCW98 - Sample 10

Observations

A light buff coloured, loose, friable, fine-coarse mortar.

Carbon dioxide emission tests give a mix ratio of:

1.5	:	1
aggregate		lime

with a hydraulicity of 0.4 (moderately hydraulic).

With stone dust in the aggregate the mix ratio becomes:

2/2.5	:	1
aggregate		lime

The lime is non-magnesian

Aggregate Mode

Sieve size	% return on sieve	Characteristics
2.36 mm	10.4%	Angular white and black coal, cream/white HTI type material, plus charcoal
1.18 mm	7.29%	Angular/sub rounded pink/white/clear/white quartz grain
0.5 mm	24%	Rounded/sub angular red/pink/clear/white quartz grain
0.3 mm	29%	Rounded/sub angular quartz grains (as above), together with some red brick fragments and charcoal
0.15 mm	15.6%	Angular/sub rounded grains (as above)
<0.15 mm	8.9%	Angular mainly clear quartz grains

This mortar could be the same as samples 9 and 12, but certainly in the sample taken, has a greater proportion of aggregate (quartz sand). This could however just be a local variation in the same mortar mix. If however there was no, or less stone dust then this could indicate a different mortar type, ie. it could be a later replication with more sand in the mix. Certainly the aggregates are similar and are probably found locally.

LCW98 - Sample 11

Observations

A friable, loose, light buff coloured fine-coarse grained mortar. Some fibrous tree roots found.

Carbon dioxide emission tests indicate a mix ratio of:

1	:	1
aggregate		lime

but with limestone dust in the aggregate would become:

2/2.5	:	1
aggregate		lime

with a hydaulicity of 0.2 (feebly hydraulic). The lime is non-magnesian

Soluble salts analysis

Nitrates	NO_3^-	0.02%
Sulphates	SO_4^{2-}	Negligible
Chlorides	Cl^-	Negligible

Aggregate Mode

Sieve size	% retained on sieve	Characteristics
1.18 mm	5.8%	Mainly angular pink/white quartz grains. Some fine grained sandstone fragments and red brick dust
0.85 mm	6.9%	As above, but rounded/sub angular clear/white/pink quartz grains
0.5 mm	23.8%	As above
0.3 mm	28%	As above, together with some black charcoal
0.15 mm	21%	As above, but angular/sub rounded
-0.15 mm	14.4%	As above, but angular and with a greater proportion of black charcoal

Apart from visible stone dust inclusions within the mortar it was impossible to differentiate between lime and limestone particles even under high magnification with a polarising microscope. There was no visible microfossils - foraminifera or coccoliths etc. in the thin sections.

The colour of the mortar is due to the butt (iron rich) limestone fragments and iron stained sand grain pellicles. The lime is non magnesian. as indicated by magneson reagent. but is probably an impure argillaceous lime. giving the slightly hydraulic properties.

Results of soluble salts analysis within the mortar:

Moisture content		2%
pH 7		neutral
Sulphates	$S04^{2-}$	0.2%
Nitrates	$N0_3^-$	1.0%
Chlorides	Cl^-	detected with silver nitrate. but not quantitatively

Aggregate Mode

Sieve size	% retained on sieve	Characteristics
1.18 mm	8%	Angular/sub rounded brown/pink rose/yellow/clear/grey quartz grains
0.85	6.6%	Rounded/sub angular mainly clear and yellow quartz grains with some red brick fragments and charcoal.
0.5 mm	33%	Mainly rounded clear and yellow quartz grains with ~ 1% of angular red orange brick dust and charcoal.
0.3 mm	36%	As above
0.15 mm	11.7%	Angular/sub rounded quartz grains (as above). but with more brick dust and charcoal
<0.15mm	4.7%	As above but angular mainly clay/salt fraction

LCW98 - Sample 12

Observations

A friable creamy/buff (slightly darker than sample 9). mortar. fine-coarse grained. with visible inclusions of white/cream stone dust and charcoal.

The mortar has characteristics similar to that of the previous samples and could certainly be the same mortar, which has simply be degraded due to damp and salt movement etc.

I hope this is the information you require.

Yours sincerely

Paul d'Armada
Hirst Conservation

APPENDIX 4
The Archive

The archive consists of:

1	Context register.
1	Section register.
11	Context sheets.
11	Masonry sheets.
16	Sample sheets.
10	Drawings.
2	Photographic registers.

All primary records and finds are currently kept at:

Archaeological Project Services
The Old School
Cameron Street
Heckington
Sleaford
Lincolnshire
NG34 9RW

The ultimate destination of the project archive is:

Lincolnshire City and County Museum
12 Friars Lane
Lincoln
LN2 1HQ

The archive will be deposited in accordance with the document entitled *Conditions for the Acceptance of Project Archives*, produced by the Lincolnshire City and County Museum.

Archaeological Project Services project code:	LCW98
City and County Museum, Lincoln Accession Number:	123.98

Archaeological Project Services
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