

DOWN HOUSE, BROMLEY (INTERIM REPORT No. 3)

*Notes on the Historic Development of the
Greenhouse and Laboratory Complex
in the Gardens of Down House*

by

Richard Lea

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Introduction

The following notes were made after visits to the house on 22/5/96 and 14/6/96. They draw on the two earlier interim reports, *Down House, Bromley, Notes on the historical development of the house*, by Richard Lea, English Heritage, May 1995 and *Darwin's Garden, The Estate and Gardens at Down House, Bromley, An interim report* by Chris Miele, English Heritage, Historical Analysis and Research Team, May 1996.

The house was purchased in May 1996 by English Heritage and is now undergoing restoration. These works will include the repair of Darwin's greenhouse and laboratory. One of the objectives is to restore the house and gardens to the appearance they had towards the end of Darwin's life. The following report is an assessment of the historic fabric surviving in the complex of garden structures at the east end of the 'Kitchen Garden' which although built in Darwin's lifetime, have subsequently been significantly altered.

This report seeks to present our current understanding of the historical development of the greenhouse and laboratory complex as a basis for considering decisions on:

- a) how the greenhouse should be repaired, for example, should it be reglazed, refroofed, partly reconstructed?
- b) how the laboratory should be repaired
- c) how both buildings should be interpreted and presented

This report is not definitive. It is simply intended to provide a platform for further research and aid decision making in the conservation programme. Suggested topics for further research which will probably prove useful to the repair of the greenhouse and laboratory are listed at the end of the report.

The development of the greenhouse and laboratory complex

The present greenhouse and laboratory complex is clearly the result of several phases of building activity. It has been possible to elucidate the major developments in its construction from a study of the surviving fabric and documentary and historical graphic sources. The construction date for the laboratory however remains uncertain, although on present evidence it would appear to date from shortly before Darwin's death in 1882.

Phase 1: garden walls and possible summerhouse, c 1845

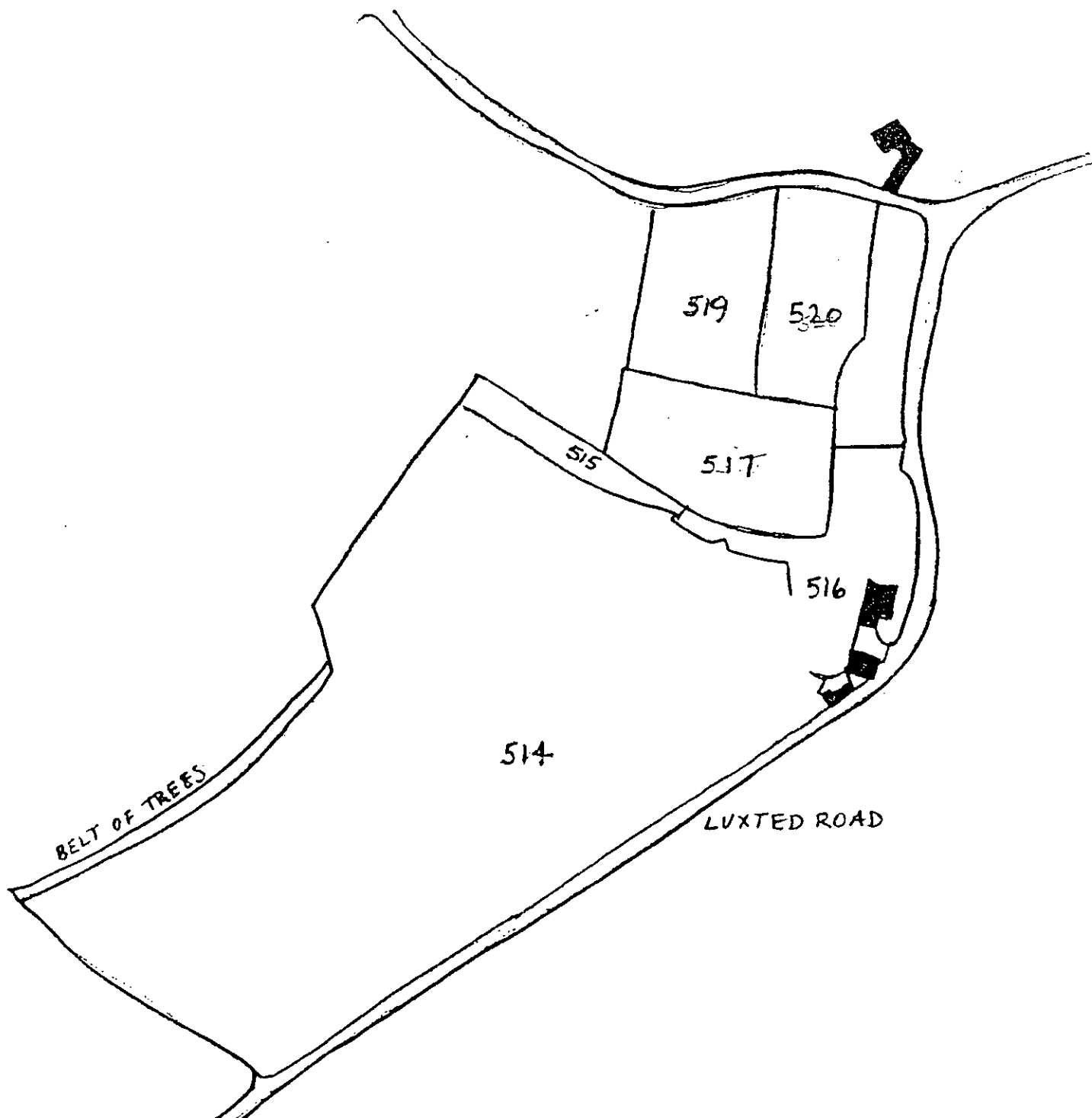
The greenhouse and laboratory were built against a flint and brick garden wall on the north side of Darwin's 'Kitchen Garden.' This wall was built abutting an earlier garden wall at its east end.

The earlier wall returned southwards, 2-3 m east of the butt joint and formed the eastern boundary of the 'Kitchen Garden.' This boundary is shown on the 1840 tithe map (ill 1). The wall, which returns southwards, is faced with flint on its north and east sides with brick quoins at its return. The west face of the south return is of red brick laid to Flemish bond. The bricks measured c 60 x 110 x 230 mm and were set in a white lime mortar. There was an offset low in the west face. An opening for a gate or door has been cut through the wall. This now has a concrete lintel but the jambs could date from the early C19. The use of brick on the west face suggests that the wall was built to enclose the property lying to the east.

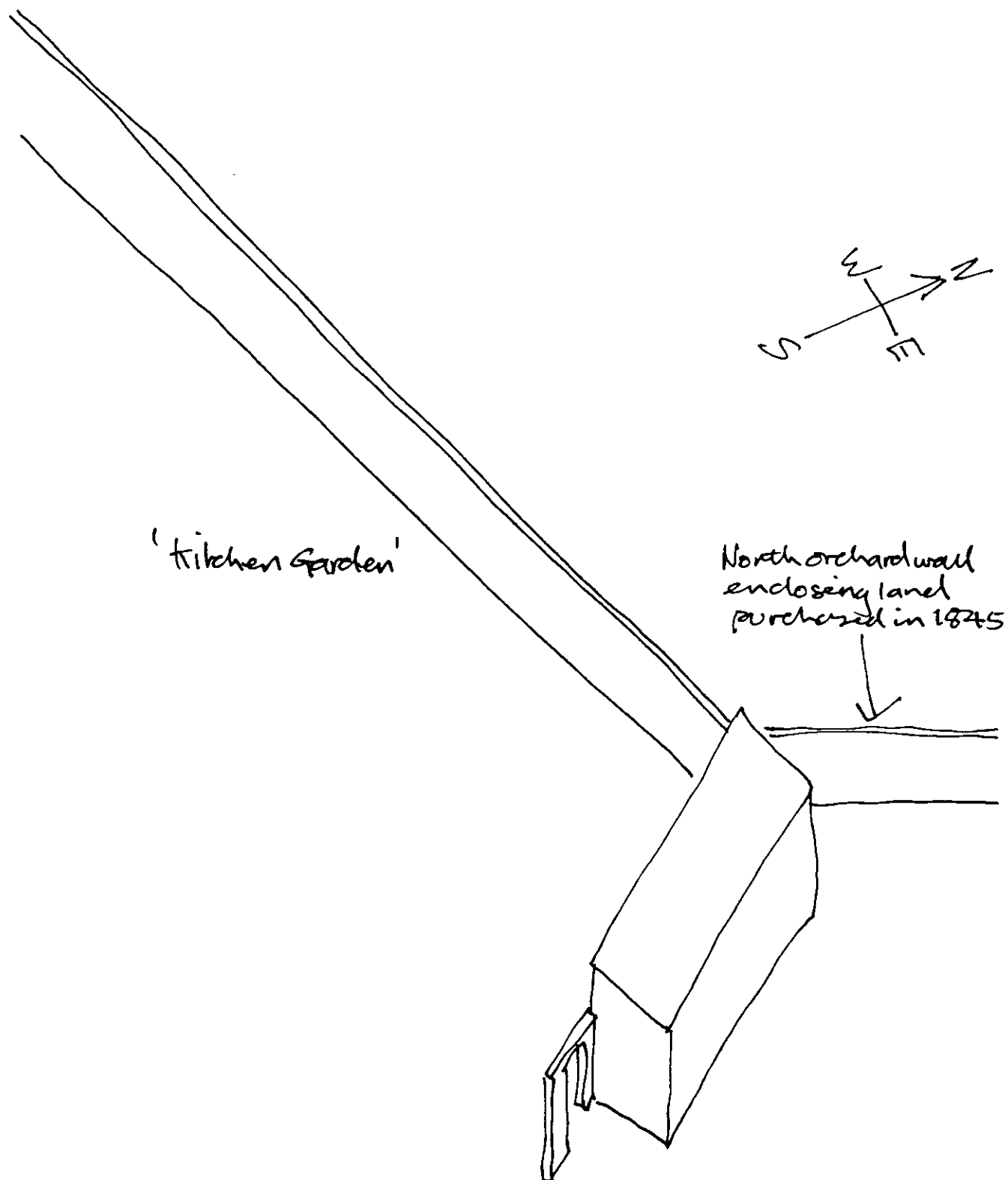
The north wall of the kitchen garden, built abutting this earlier wall, was finished with brick on its south face, laid to Flemish bond. The bricks, measuring 60-65 x 105 x 230 mm, are red, although the dark headers create a diaper effect. Its north face was finished in unknapped flint, with a raked offset at c 1.0 m above ground level. This offset is now rendered but apparently was left simply as flint. There were vertical bands of brick at c 5.0 m intervals in the north face. The brick face to the south and the offset on the north suggest that the wall was built to enclose land lying to the north.

The OS map of 1868/9 (ill. 5) shows a third wall was shown enclosing the north side of the orchard lying immediately to the north of the house. This wall apparently met the wall at the east end of the 'Kitchen Garden' at or near the westward return at its north end. Not shown on the tithe map of 1840 (ill. 1), it was probably built to enclose the area later known as the 'North Orchard' purchased from Mr Sales by Darwin in August 1845 (see C Miele pp 6 and 10). It was presumably demolished when Darwin extended the orchard to the north-west in 1881 (see Phase 5 below).

The OS map of 1868/9 also shows a building, which was probably a lean-to, constructed against the east face of the garden wall at the east end of the 'Kitchen Garden.' Although this building appears to have survived until the 1930's (see ill. 11) we have no record of its appearance. The hatching used to designate its character on the OS map of 1895/6 (ill. 8) identifies it as a roofed building rather than as a greenhouse. Its location at the west end of the garden immediately west of the house, suggests that it was probably a summerhouse.



2 Sketch axonometric of Phase 1, showing the garden walls at the east end of the kitchen garden, with the garden wall (to the right) enclosing the orchard purchased in 1845



Phase 2: construction of the hothouse in the winter of 1862/3

The present greenhouse is the product of several phases of building activity. The earliest section was probably the east bay, 4.8 m in length, which was constructed with bricks laid on edge, as in rat trap bond. This must surely be the hot-house built for Darwin in the winter of 1862-63 by Horwood, Sir John Lubbock's gardener (see C Miele p 14). Sir John Lubbock lived nearby.

On December the 24th 1862, Darwin wrote to Joseph Hooker, 'And now I am going to tell you a most important piece of news!! I have almost resolved to build a small hot-house; my neighbour's first rate gardener has suggested it, and offered to make me plans, and see that it is well done, and he is a really clever fellow, who wins lots of prizes, and is very observant. He believes that we should succeed with a little patience; it will be a grand amusement for me to experiment with plants.' And on February 5th 1863, 'I write now because the new hot-house is ready, and I long to stock it, just like a schoolboy. Could you tell me pretty soon what plants you can give me; and then I shall know what to order? And do advise me how I had better get such plants as you can spare. Would it do to send my box-cart early in the morning, on a day that was not frosty, lining the cart with mats and arriving here before night? I have no idea whether this degree of exposure (and of course the cart would be cold) could injure Stove-plants; there would be about five hours (with wait) on the journey home.' And apparently about the same time to his neighbour Sir John Lubbock, 'My little hot-house is finished and you must allow me once again to thank you for allowing Horwood to superintend the erection. Without his aid I should never have had the spirit to undertake it; and if I had should probably have made a mess of it.'

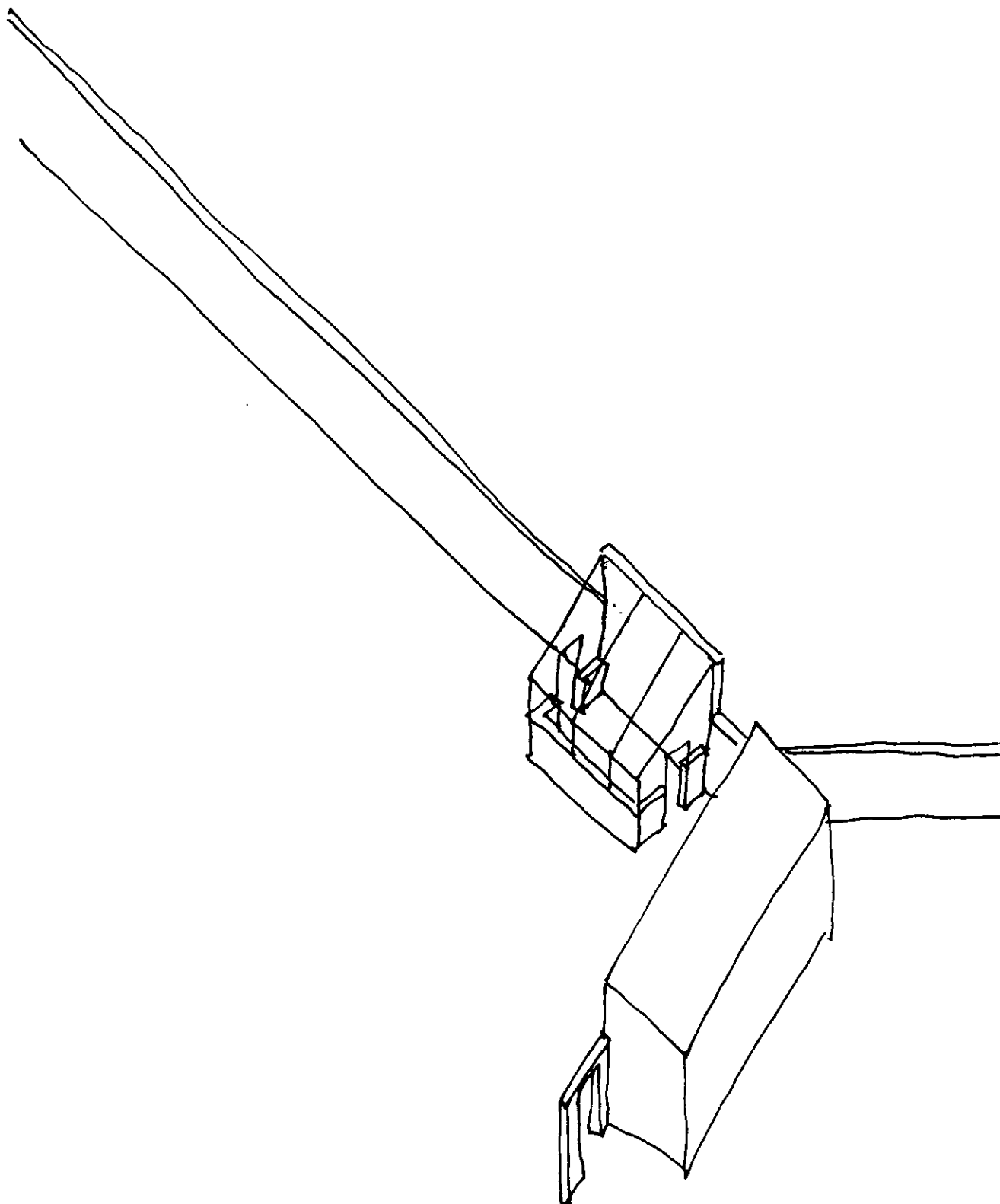
The semi-cavity wall probably provided additional insulation. A single length of heating pipe survives on the floor of this bay, and although it is not clear whether this form of heating is original similar piping is shown in the view published in 1883 in the adjacent cell of the extended greenhouse (ill. 6).

The garden wall was heightened by eight courses of brickwork laid approximately to Flemish bond. The western termination of this heightening is currently exposed on the north face of the wall immediately west of the laboratory stack.

It is not clear at this stage in the research how much of the original timber survives. However, the associated heightening of the garden wall suggests that the general size and form of the roof cannot have been significantly different from the present roof.

The present glazing bars are ovolo moulded although some have clearly been replaced with plain chamfers. It is quite possible that some of the ovolo moulded glazing bars are original. The principals are spaced at 1.60 m intervals, each divided into four by glazing bars for panes of glass c 390 mm (15") wide. This system employs a slightly smaller module than the surviving roof to the west, where the principals are set at 1.68 m intervals (see below). The difference could be due either to the survival of original joinery or the need to fit within the plan of the surviving brickwork.

3 Sketch axonometric of Phase 2, showing the addition of the 'hothouse' against the wall on the north side of the 'Kitchen Garden.'



Phase 3: construction of the greenhouse in March 1863

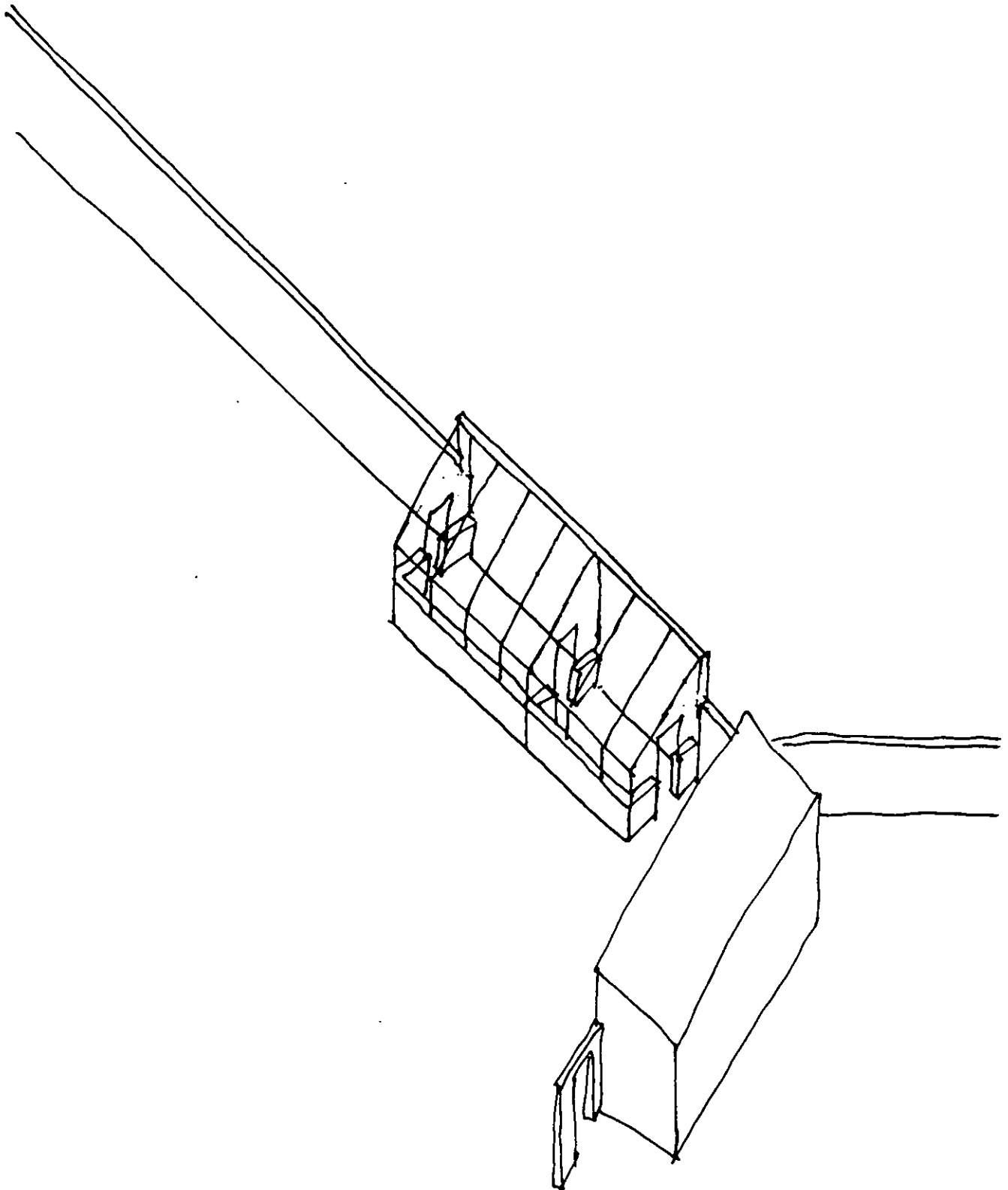
In March 1863 a second bay, 6.7 m in length, was constructed abutting the west face of the earlier hothouse and against the north wall of the 'Kitchen Garden.' The brick walls are of brick laid to Flemish bond. The walls 9" thick. At its west end there were closers in the south face for the north return wall. This structure incorporated a brick platform at window sill level and was heated by two lengths of heating pipe. These pipes are shown in the interior view of the greenhouse published in 1883 (ill. 6).

The joint between the brickwork of the 'hothouse' and the second bay is hidden by render surrounding the point of entry for cast iron pipes which heated the middle and eastern bays, obscuring the archaeological relationship between the two brick walls. However, it would appear that, since the brick on edge construction continues as far as and includes the thickness of the internal return wall, the second bay was probably built abutting the 'hothouse'.

Once more with regard to the roof, it is difficult to know how much of the present roof is original. However, the module of 1.68 m between principals and panes of glass c 410 mm (16") wide, used to roof the addition to the west (see phase 4), was probably established here.

Documentary sources refer to a greenhouse built for Darwin, in March 1863, again by Lubbock's gardener, H [Horwood?].

4 Sketch axonometric of Phase 3, showing the addition of the greenhouse, built in the summer of 1863



Phase 4: the westward extension of the greenhouse, by 1868/9

By 1868/9 the greenhouse had been extended a further 12.2 m westwards, thus doubling the size of the complex to an overall length of 23.7 m. The Flemish bond brickwork closely resembles that of the second bay.

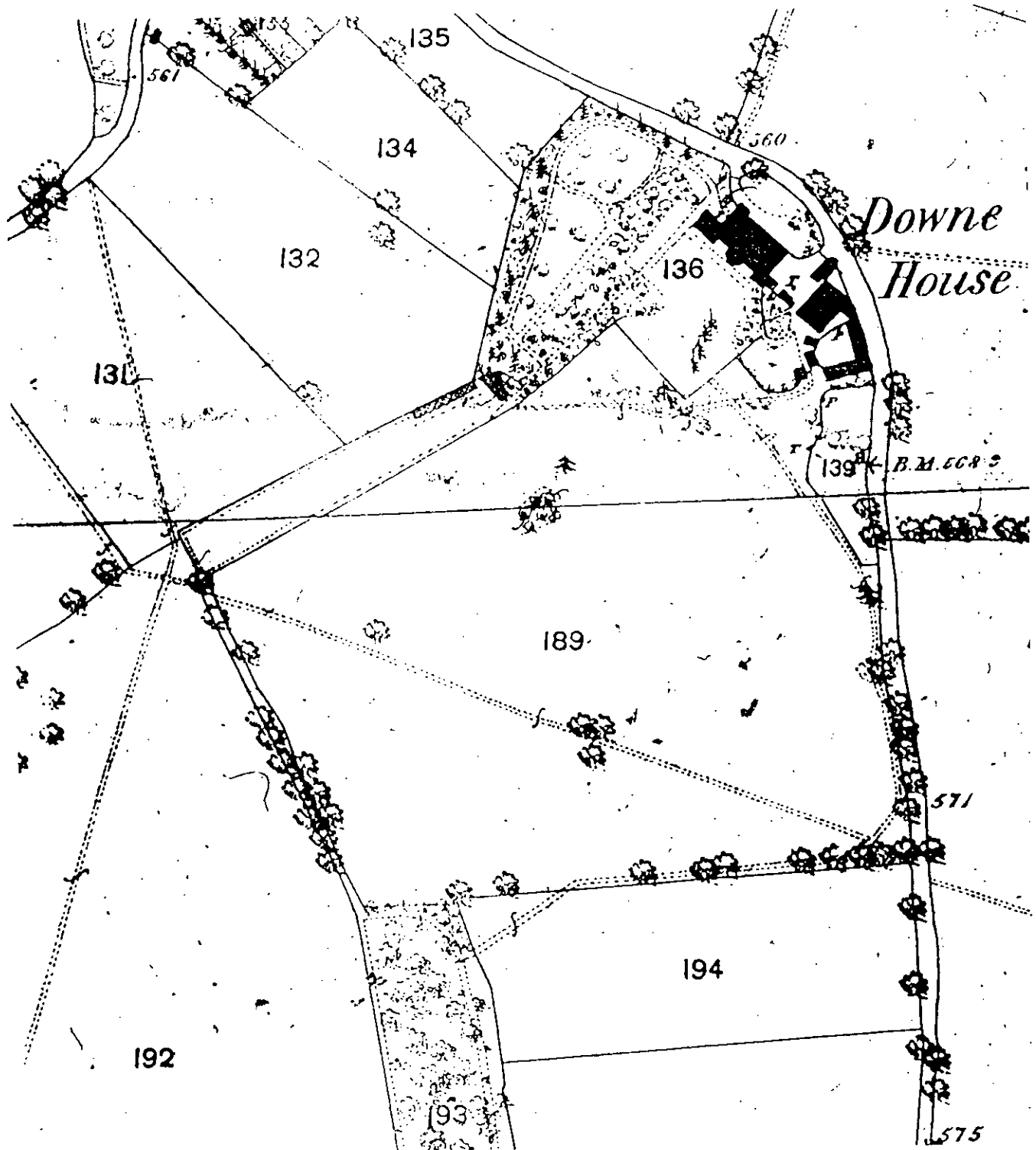
Although the brick work of the west bay is similar to that of the second bay, there is a clear vertical but joint between the two builds. Because this joint lies to the west of the return wall for the west end of the middle bay, the construction of the west bay followed that of the second bay. The addition does not appear to have been heated.

The garden wall was heightened by the addition of green house of seven courses of brick, presumably to accommodate the lean-to greenhouse roof which, although possibly not the present structure, was similar to it.

The resulting greenhouse was therefore divided into four cells and glazed with principal rafters subdividing the cells into the symmetrical rhythm of 3,4,4,3.

A greenhouse c 24 m long is shown in this location on the First edition Ordnance Survey map of 1868-69 (ill. 5). This map also shows a lean-to structure on the east side of the east wall of the 'Kitchen Garden.' This may well be the 'gazebo' or 'poison house' referred to on page 159, in *Period Piece, A Cambridge Childhood*, by Gwen Raverat, 1952.

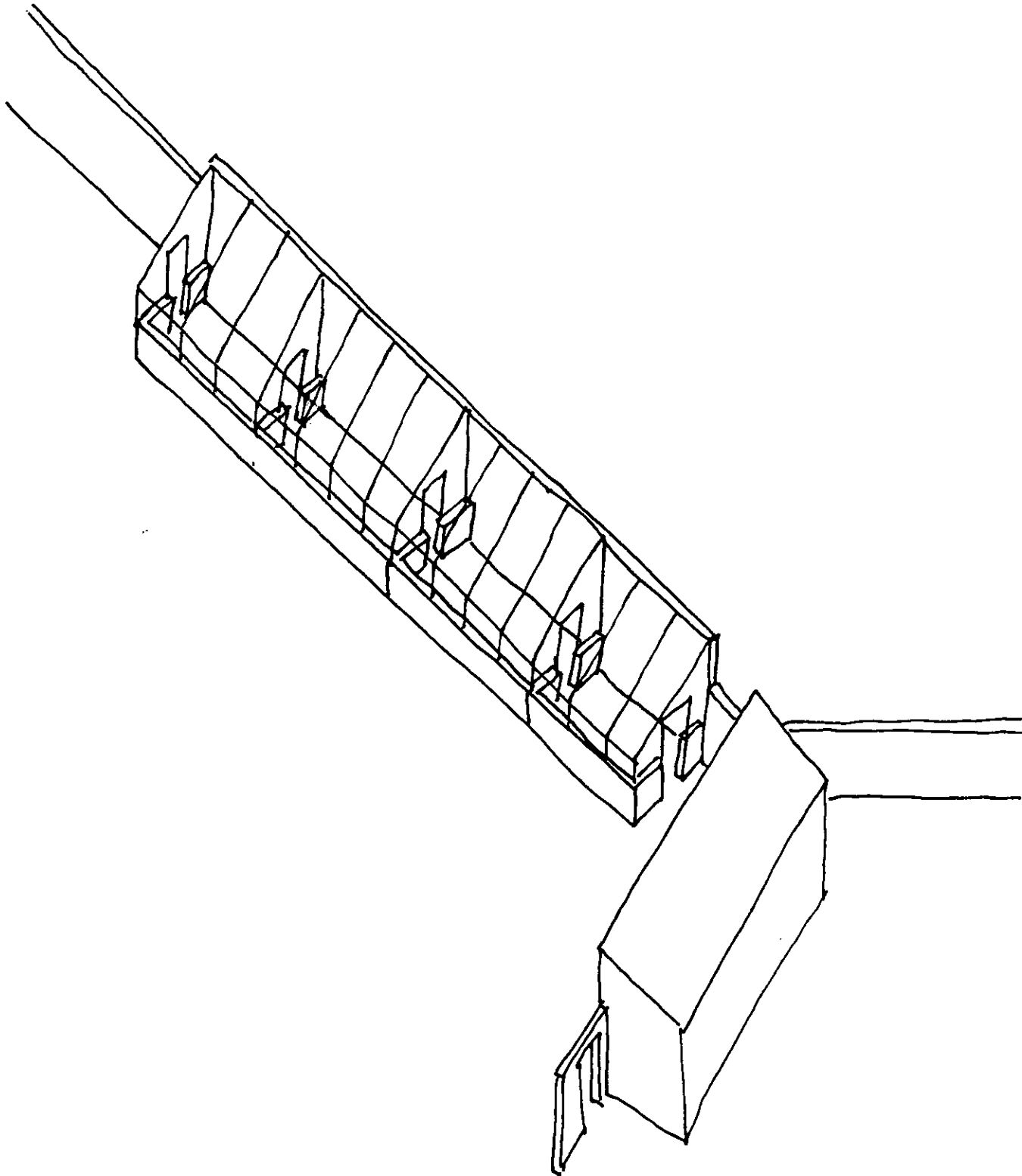
The interior view of the greenhouse published in the *Century Magazine* in 1883 appears to show four cells in all. This view therefore appears to have been drawn before the addition of the final western cell which suggests that if the later addition of another cell (see Phase 5 below) was made in Darwin's lifetime - he died on the 19th of April 1882 - then it was probably made not long before his death.



6 An engraving of the interior of the greenhouse, looking westwards from within the easternmost bay, published in *The Century Magazine* in 1883



7 Sketch axonometric of Phase 4, showing the heightening of the garden wall, the westward extension of the greenhouse and the probable introduction of the present roof-line and glazing system.



Phase 5: further westward extension to the greenhouse and the construction of the laboratory c 1881

The greenhouse was extended westwards yet again by a further 5.3 m. In this extension the bricks used were a brighter orange red, and measured 70 x 110 x 225 mm. The same bricks were used to heighten the garden wall, according to the pattern established to the east. This addition must follow the drawing which shows only four cells of the greenhouse published in the *Century Magazine* in 1883 (ill. 6).

Darwin purchased the land immediately north of the 'Kitchen Garden' in 1881-2 (see C Miele, pp 6 and 13). The garden wall built to enclose the north and west sides of the newly acquired property was of flint construction with horizontal bands of brickwork of three courses. The bricks were yellow red and purple and measured 65-70 x 110 x 230 mm.

The construction of the brick structure, now known as Darwin's Laboratory must have followed this purchase since it lies on the north side of the 'Kitchen Garden' wall. At the top it was built over the heightening of the garden wall which relates to the construction of the greenhouse roof. If this interpretation is correct, then it appears that Darwin could not have had much use of the building before his death in 1882. It does seem unlikely that the laboratory was built after his death.

To date, documentary evidence for the laboratory is generally lacking. In 1874 it was still located in the house - 'Frank came down from the village most days and was always pottering in the greenhouse, experimenting on plant fertilization, or tinkering upstairs in the lab' (*Darwin*, Desmond and Moore, p 617). The reference to 'upstairs' implies the laboratory was located on the first or second floor.

A photograph (ill. 7) which shows the north end of the Sandwalk with the 'Hollow Beech' includes the figure of Horace Darwin (1851-1928) probably dates from c 1880. From the appearance of Horace Darwin this date is likely to be later rather than earlier. The photograph shows the greenhouse in the background with the laboratory rising above the garden wall.

The present arrangement of buildings is shown on the Second edition Ordnance Survey map of 1895-6 (ill. 8). The laboratory, glazed area to the west and the small lean-to structure and the greenhouse are all shown. The greenhouse is shown at its full length of 29 m.

The present laboratory now consists of the brick shell of the lean-to building against the garden wall, immediately north of the greenhouse. It had two windows in the eastern half of the north wall a fireplace in the middle of the south wall, that is, against the garden wall, and an entrance door through the garden wall from within the eastern bay of the greenhouse. The brick reveals of the doorway were uniform with the construction of the outer walls. The design of the doorframe indicates that it was built as an internal door. This fits with the evidence of the brick work which indicates that the construction of the greenhouse/hothouse pre-dates the construction of the Laboratory.

Sockets in the walls indicate that the suspended timber floor was supported in part by brick footings running the length of the building from east to west. Joist sockets at eaves level reveal that the interior had a ceiling, although their absence from the south west corner and plaster on the south wall at a high level, suggests that it was interrupted in this area. This feature probably relates to the large brick platform at ground floor level and the treatment of the parapet wall above the roof line. In the west wall was a small window which has been altered. In the east wall, a doorway has been cut through but this feature is probably contemporary with the bomb shelter built against the east wall.

The interior, apparently a single room, was plastered. No alteration was made to the offset in the north face of the garden wall. The application of plaster to the walls respected various timber features, now removed, which give some indication of how the building was originally used. The fireplace had a plain rectangular surround, executed in a hard plaster or render. The same material was used to simulate a skirting board around the room. The fireplace opening was reduced in size with yellow stock bricks and a moulded firebrick hearth inserted, probably in the 1920's. The ironwork, however, is probably Victorian.

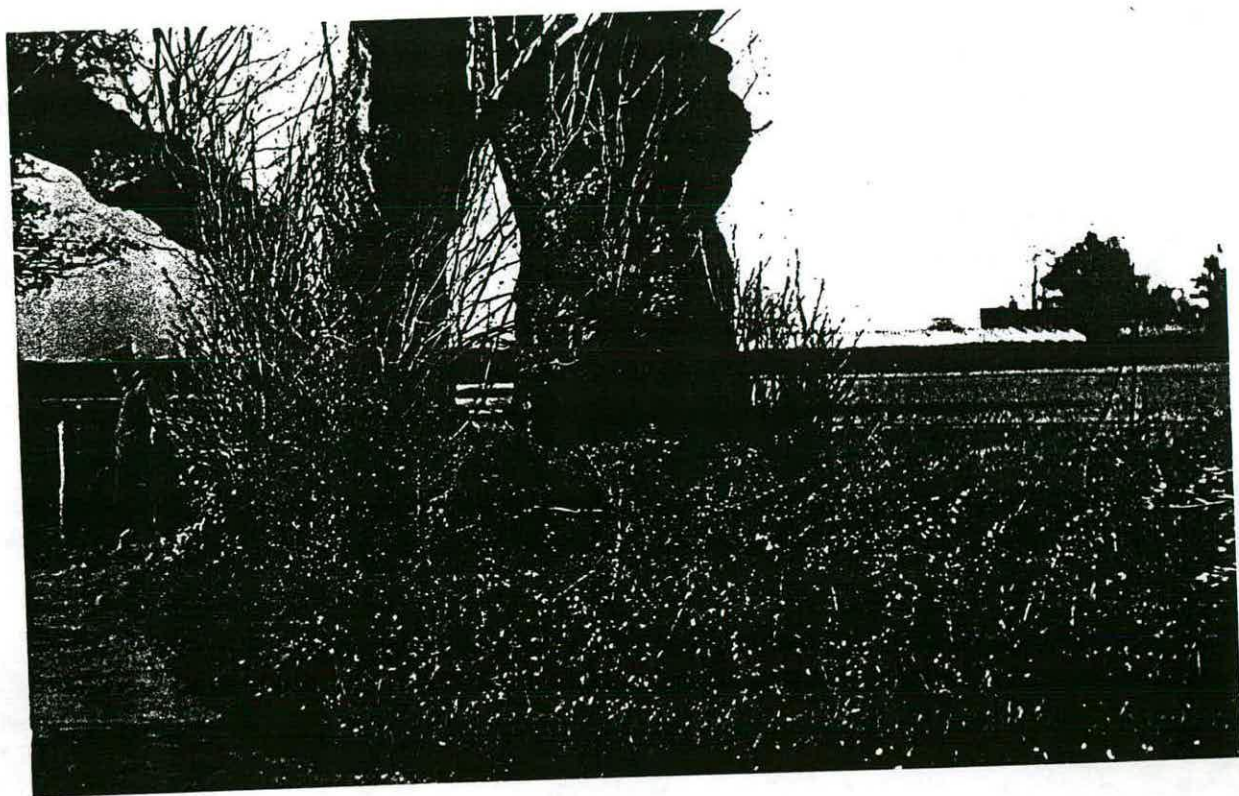
The scale, location of the building, single point of access from the greenhouse, provision of heating and simply plastered interior lean-to roof, fit with the identification of this building as a laboratory or study room.

The interior is recognisable in a photograph reproduced in the Down House School Prospectus and referred to as 'The Laboratory' (ill. 10). The photograph shows the room viewed from the west, with the two windows in the north wall, the door at the east end of the south wall and a ceiling beam which is implied by the socket above a brick pilaster in the surviving fabric. There were sliding shutters suspended on an iron rail above the window heads and cupboards against the south wall. There appears to be a glow of light falling on the floor from the fireplace against the south wall hidden from view by the cupboard. The sashes are without glazing bars but then the windows in the additions to the house of 1858 have similarly large sheets of glass. The general appearance of the room, especially the sliding shutter arrangement suggests an Edwardian date. The ironwork can probably be dated by reference to trade catalogues. Further research may shed some light on this most important building.

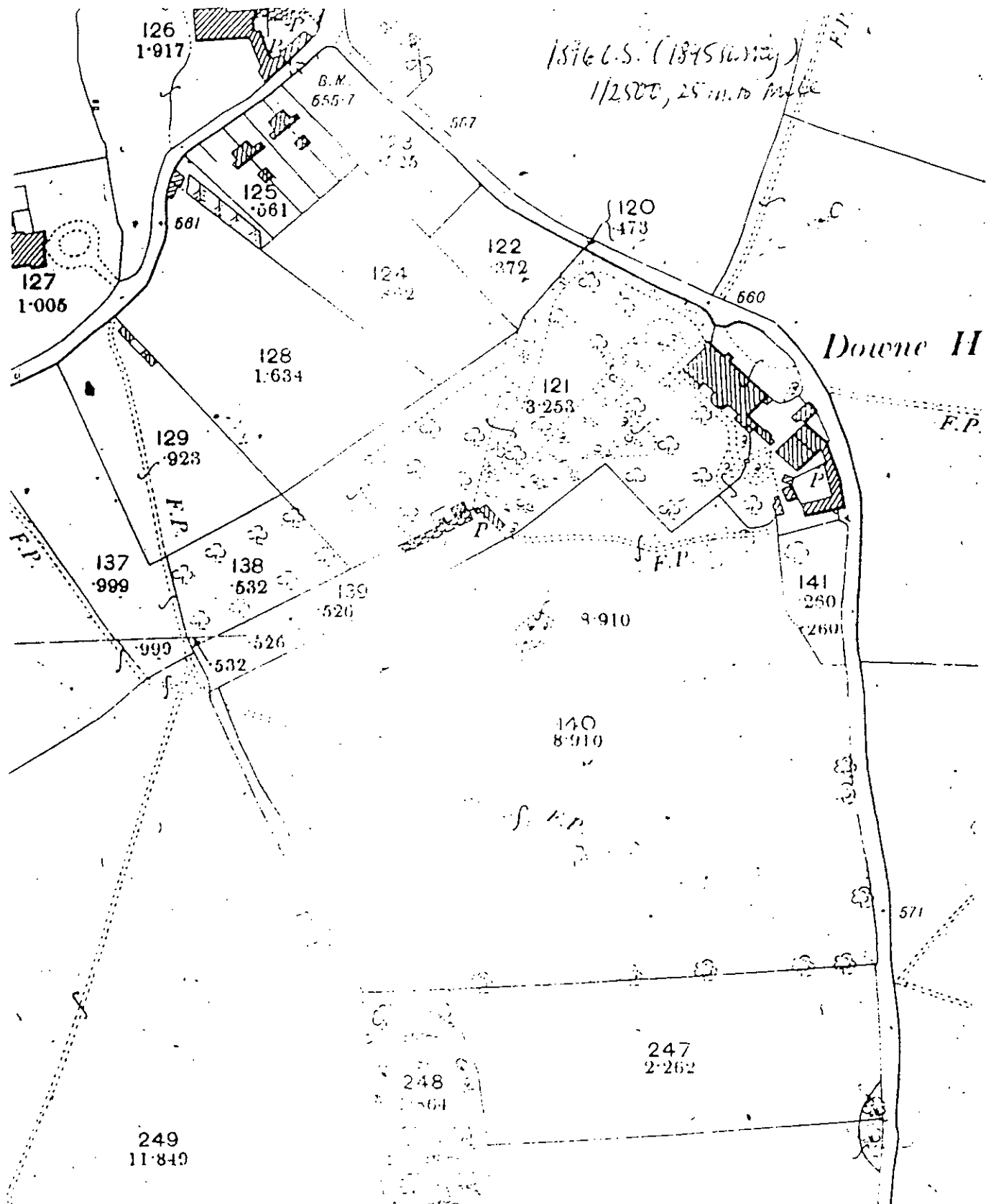
Immediately to the west of this structure was a cement floor for a square structure, the same width as the Laboratory. In the exterior face of the west wall of the Laboratory is the diagonal scar of another lean-to roof. This presumably covered the area represented by the cement floor. The absence of scars of walls on the side of the laboratory and in the floor suggest that this was a lightweight timber structure.

Immediately to the west of the cement floor area is a smaller brick lean-to structure built against the garden wall. This had a door in its north wall and a small window in the west wall. The arched doorway through in the west wall was crudely cut and the cut bricks covered in cement render.

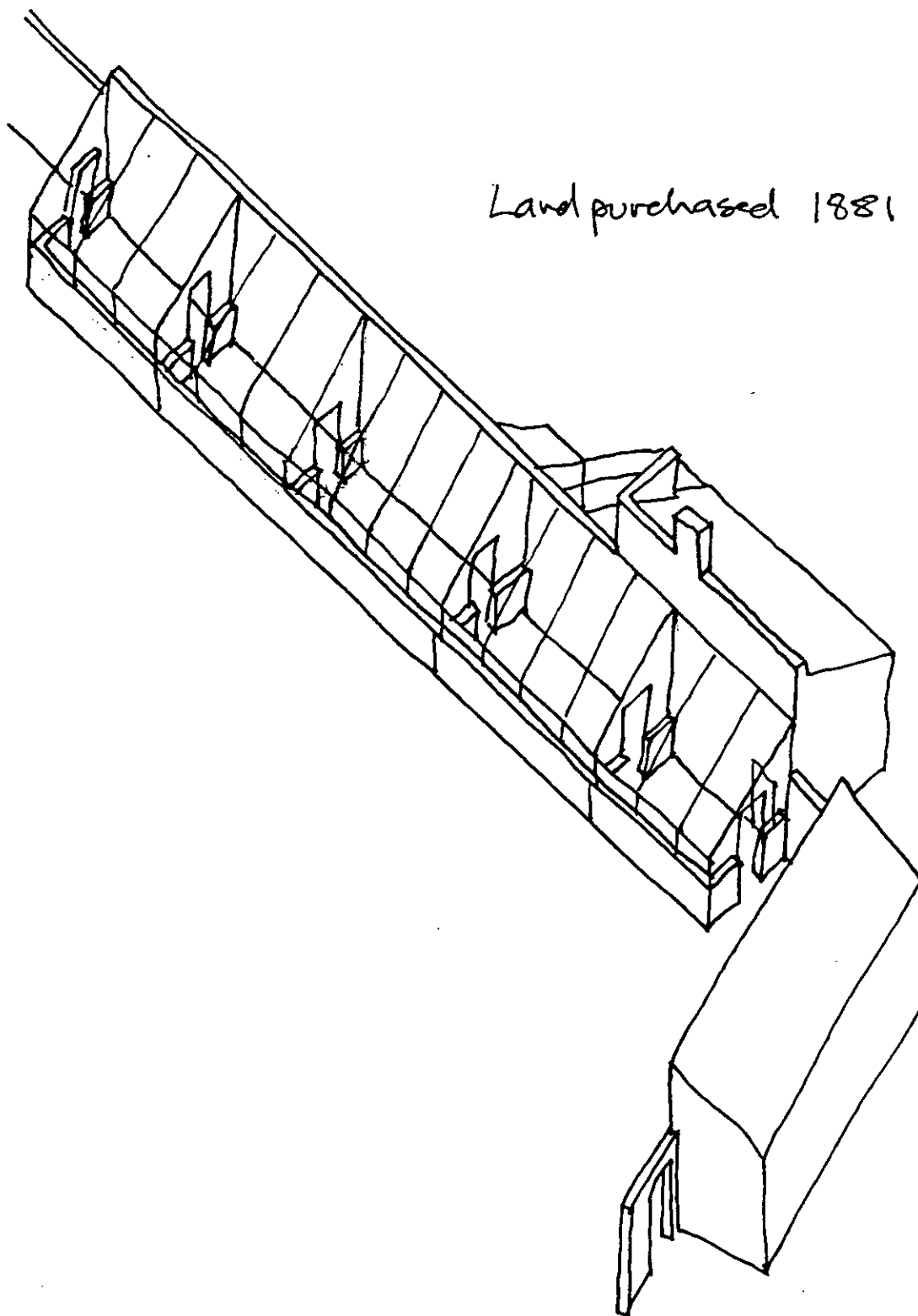
8 A detail of the photograph of the north end of the Sandwalk with Horace Darwin in the foreground, probably c 1880 (Darwin Museum, Down House).



9 Second edition Ordnance Survey Map, 1895-96, scale 1:2500



10 Sketch axonometric of Phase 5, showing the addition of a bay to the west end of the greenhouse and the construction of the laboratory on the north side of the garden wall, with a glazed hard standing to the west and a small brick lean-to.



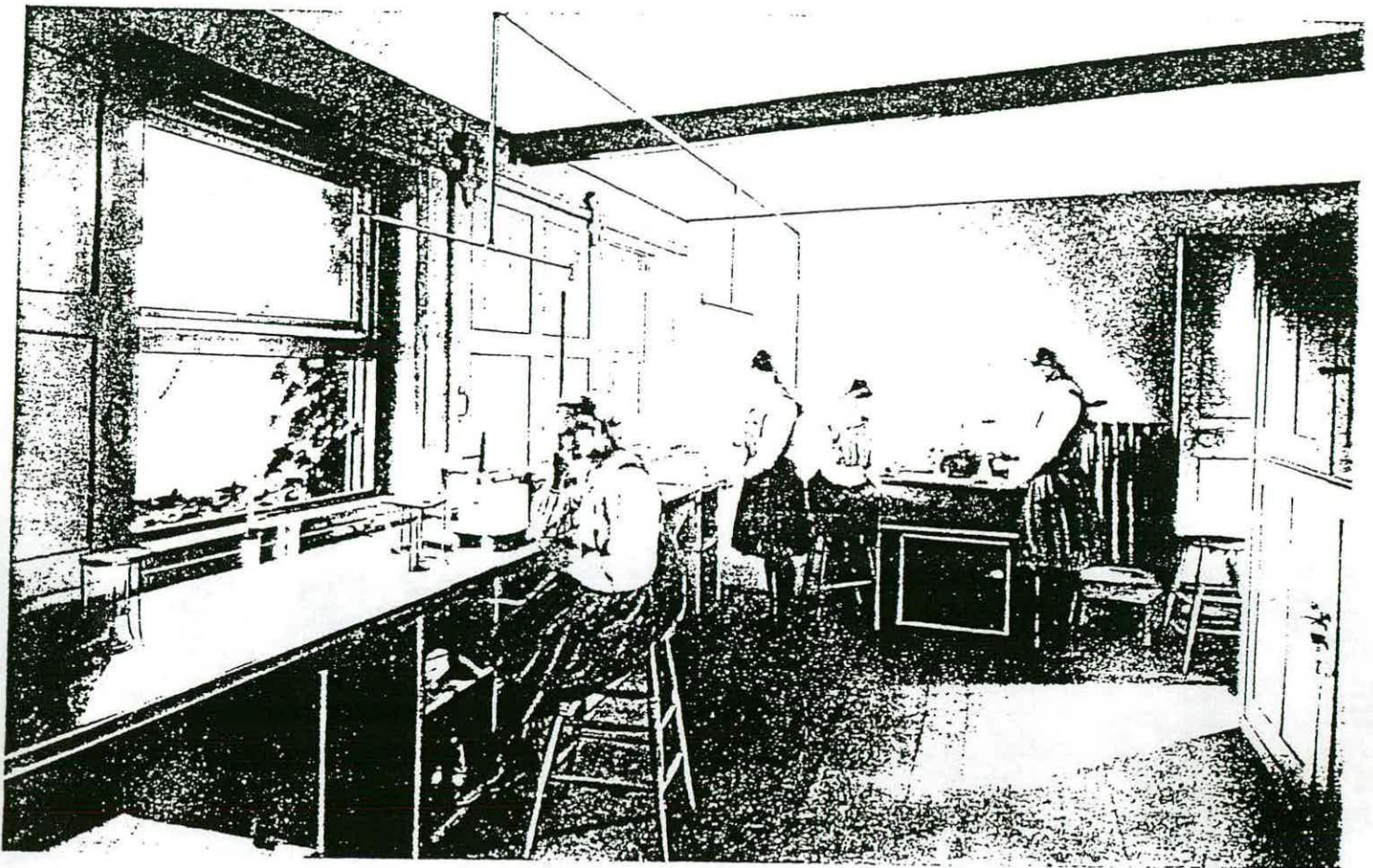
Phase 6: contraction of the greenhouse and introduction of a mechanism for the opening and closing of the greenhouse windows, by c 1930

The greenhouse was reduced in length by c 10.8 m from its west end. This probably occurred in the 1920s since it is first shown on the map of the estate after conversion to the Buckstone Browne Research Farm about 1930 (ill. 11).

The reduction appears to have been accompanied by an overhaul of the roof timbers. At the same time two courses of yellow stock bricks were laid on top of the earlier greenhouse walls. This was presumably accompanied by repairs to and partial replacement of the timber sills.

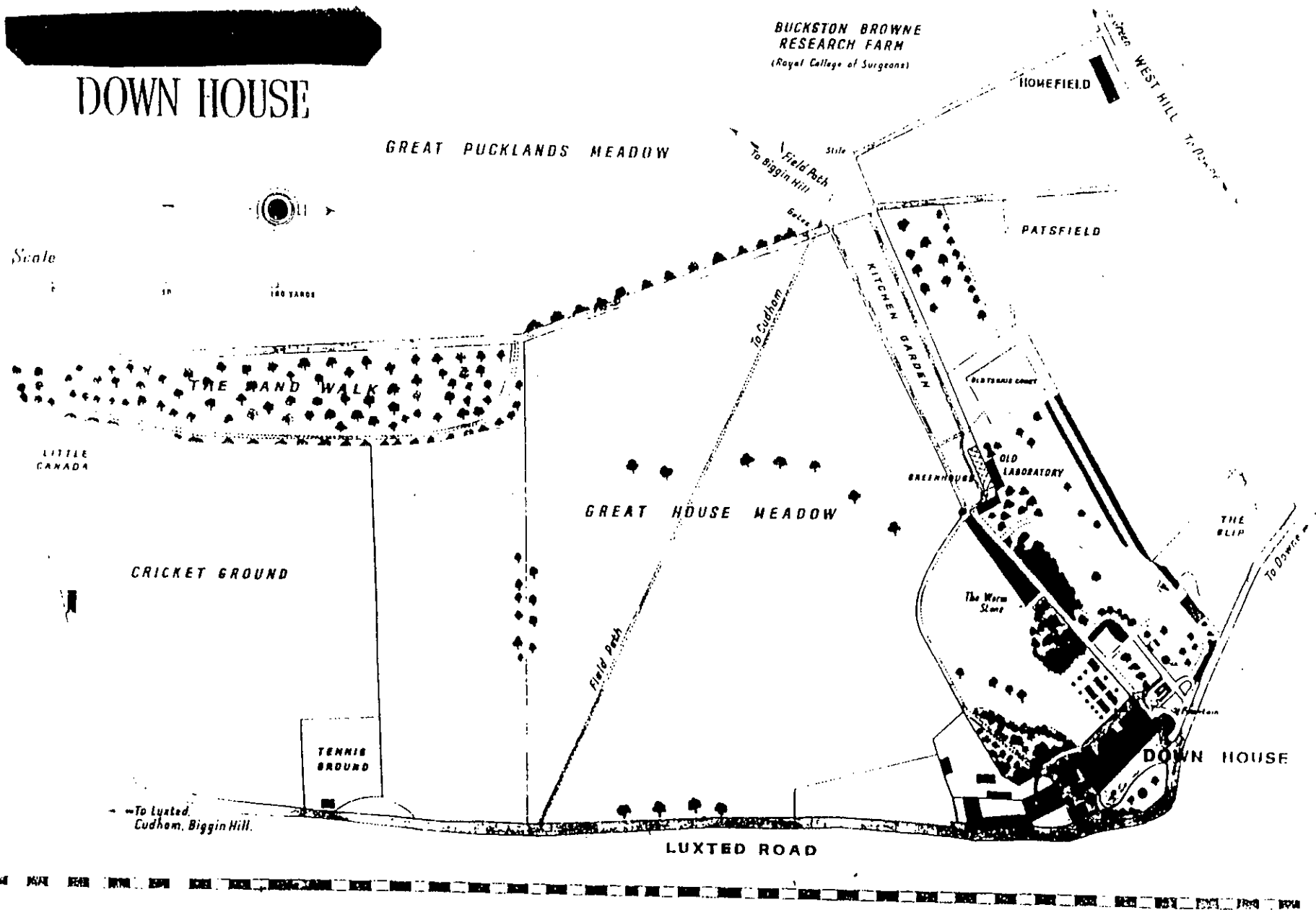
The present glazing system incorporates a mechanism of metal levers and threaded rods operated by cast handles bearing the inscription 'Boulton and Paul, Norwich' for the controlled opening of the windows throughout the greenhouse. This mechanism does not appear to be Victorian and both the castings and porcelain handles suggest a date in the 1920's or later. A more precise date for this system can probably be established through historical research.

11 Interior of the laboratory, a photograph reproduced in the Downe House School prospectus, probably c 1910, since the same prospectus includes photographs of the gymnasium and studio built in 1909.



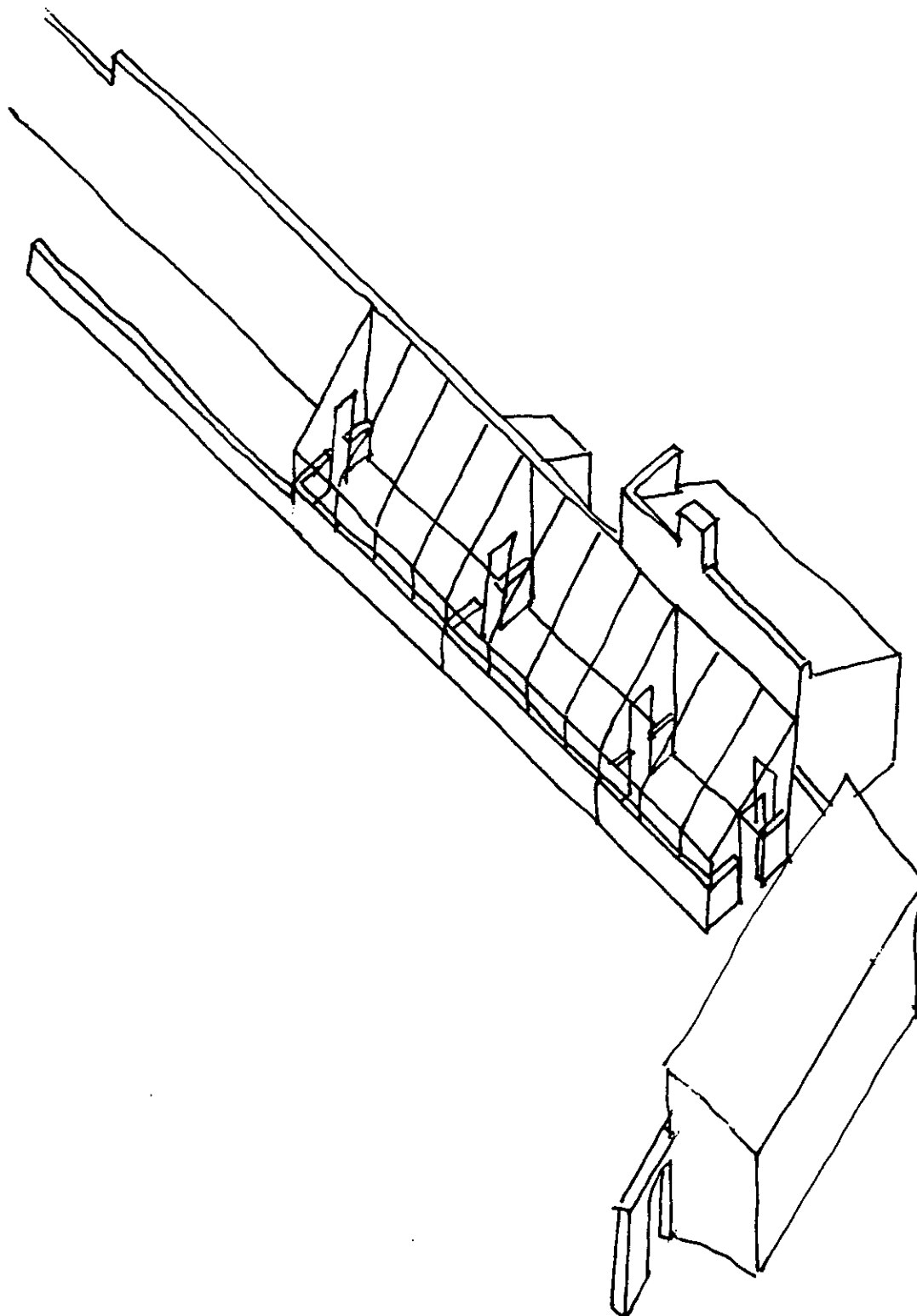
The Laboratory

DOWN HOUSE



12 Map of Down House after conversion to Buckstone Browne Research Farm, c 1930, Darwin Museum, Down House, Downe, Kent. This map shows the ? summerhouse built against the east face of the east wall of the 'Kitchen Garden' still standing.

13 Sketch axonometric of Phase 6, showing the greenhouse reduced in length, with the south wall left standing to the west of the glazed section. The introduction of the Boulton and Paul mechanism for the opening and closing of the windows probably dates from this phase.



Topics for further research

The following subjects could be researched through building analysis or documentary research.

- the joinery for the glazing of the greenhouse has been extensively repaired, however a careful drawing of its detailing would probably reveal the extent to which historic fabric either survives or has been reused

this work is also necessary to any programme of repair

- the interior of the laboratory was pictured in a photograph reproduced in the Downe House School prospectus. It shows an unusual shutter arrangement which can probably be identified through trade catalogues. The date of these fittings may provide a clue to the date of the laboratory

the interior shown in the photograph needs to be thoroughly researched before any attempts to reinstate it can be made

- closer analysis of the brickwork would probably reveal more about the roof structures for the earliest phases of the greenhouse

this needs to be researched before any repointing takes place

- the date of the laboratory has not yet been established. It was there by the time the OS surveyed the area for the map 1895-6, it hardly seems possible that it was built in the intervening years after Darwin's death and yet it seems to have been built late in the sequence of buildings now comprising the greenhouse complex.

- some of the glass is possibly historic. A survey is needed before replacement or repairs are carried out