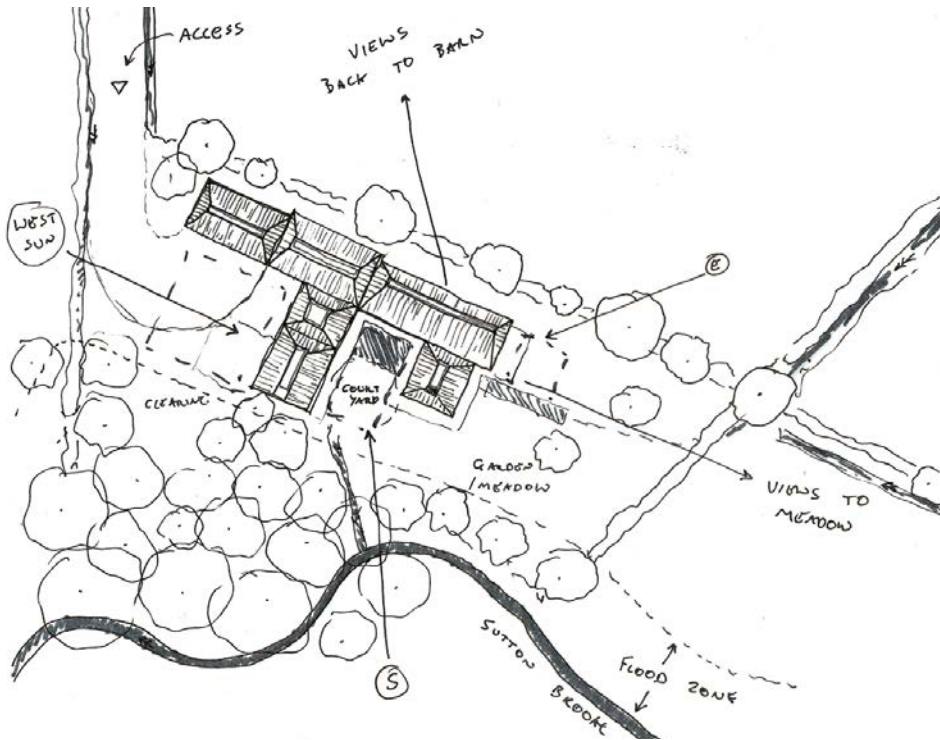
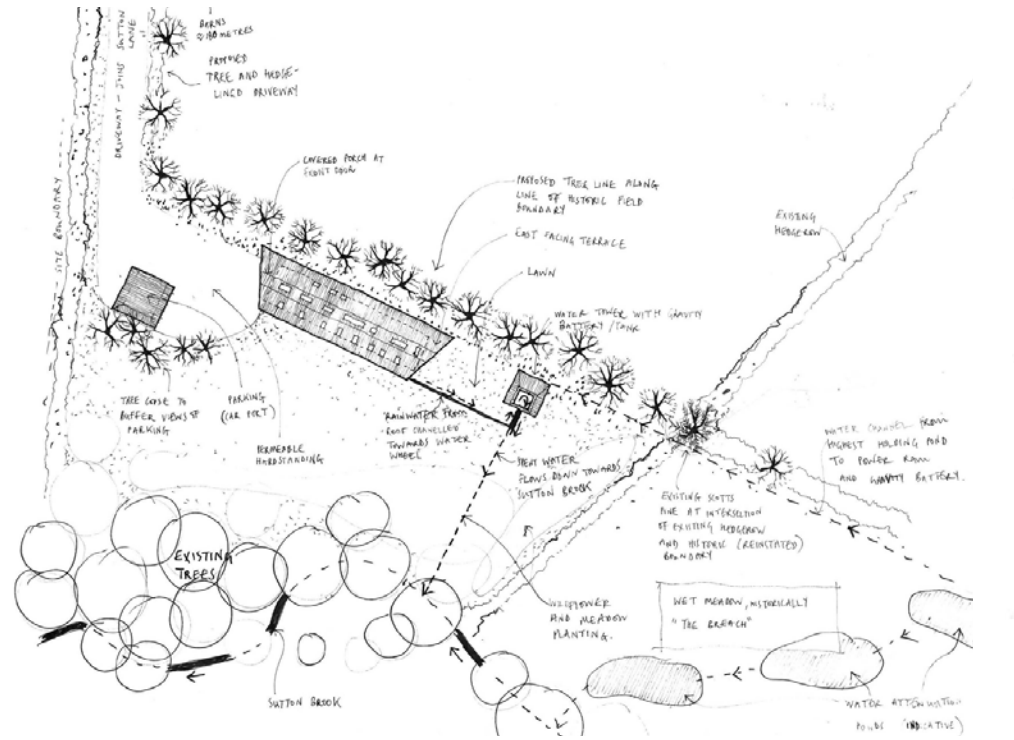
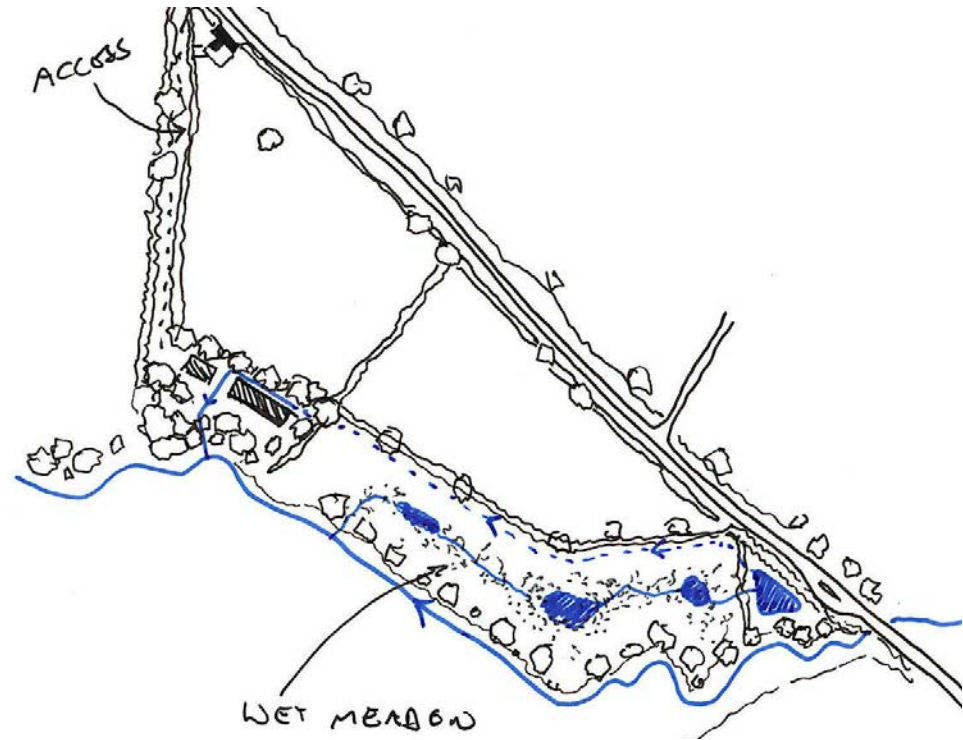
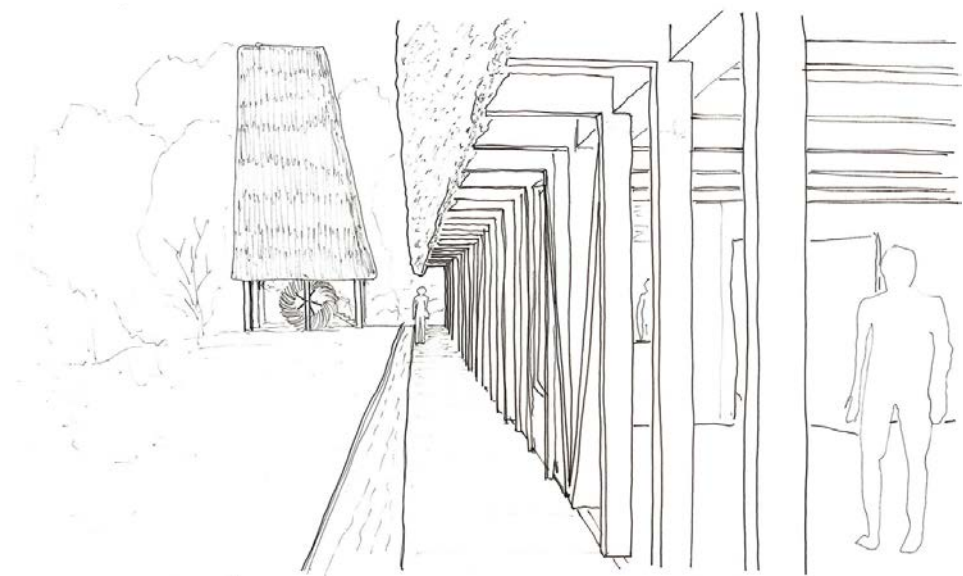
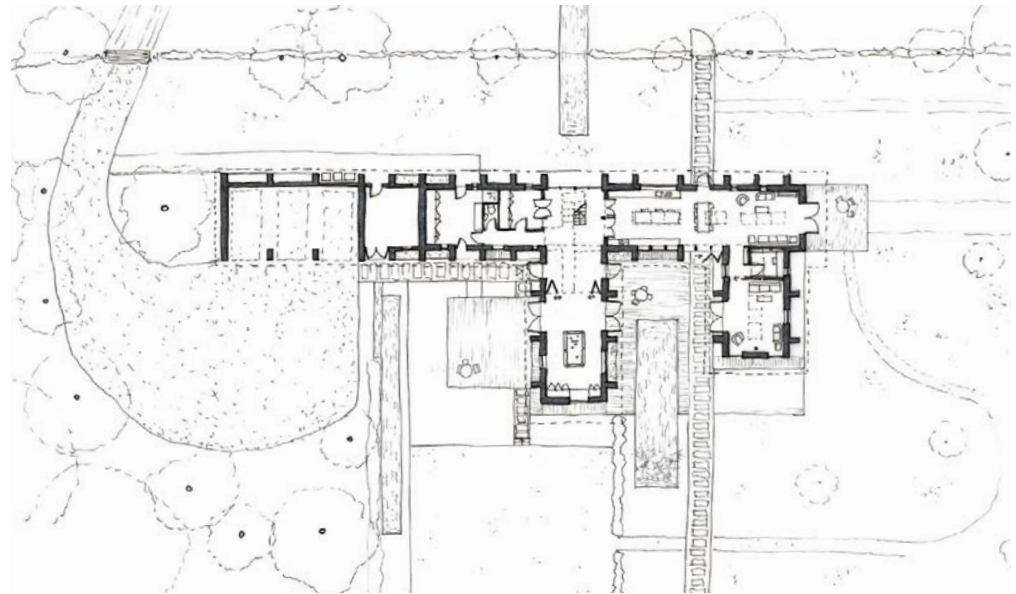
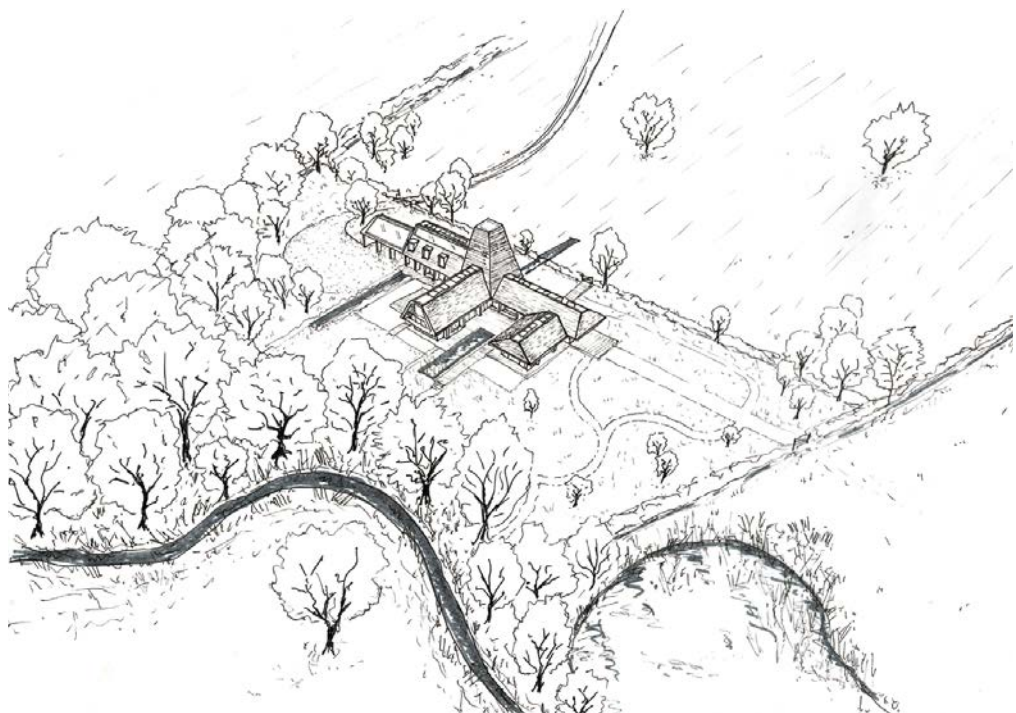
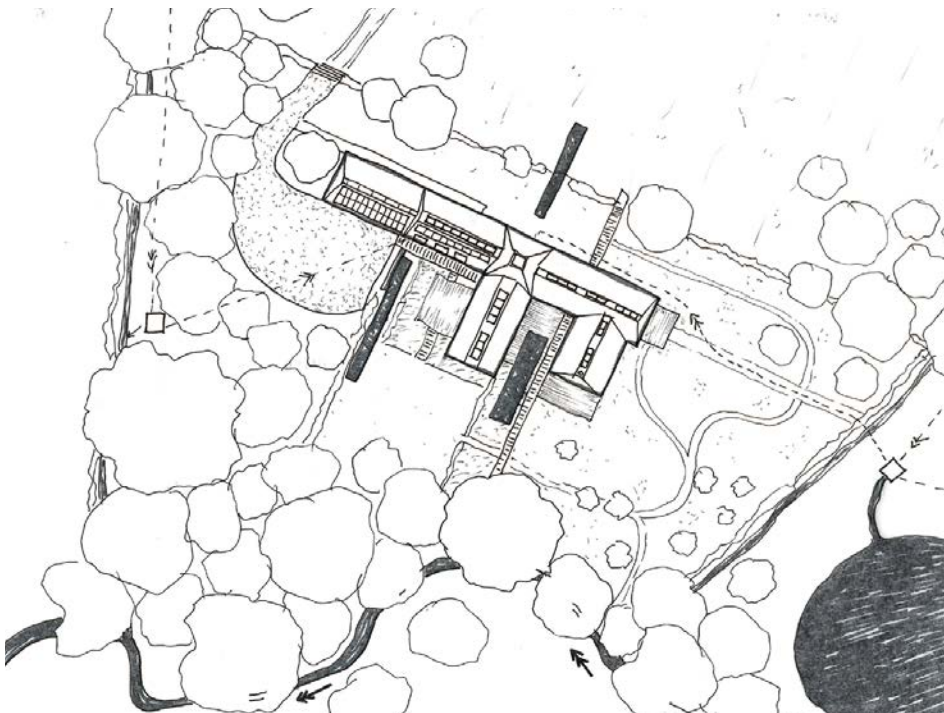
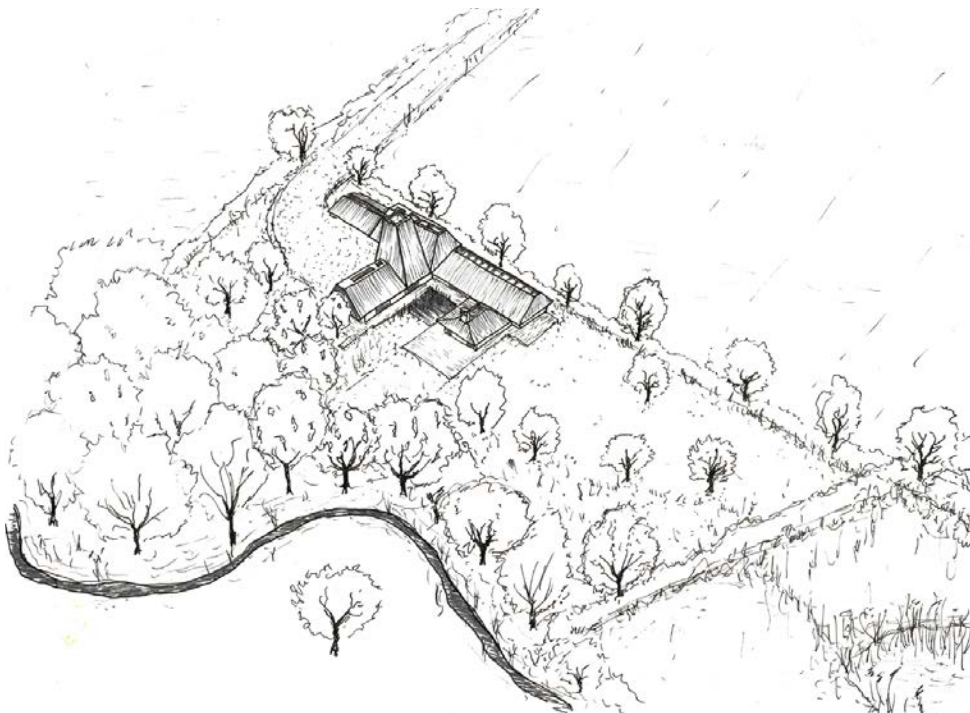
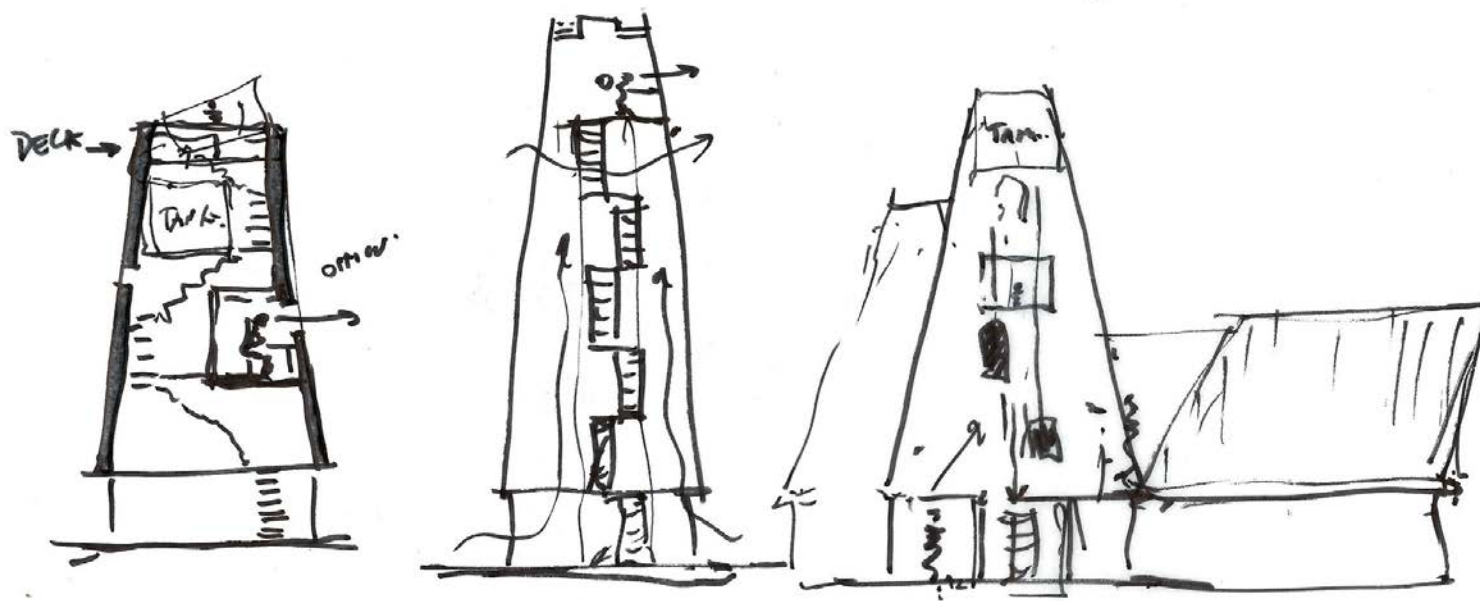


Appendix A

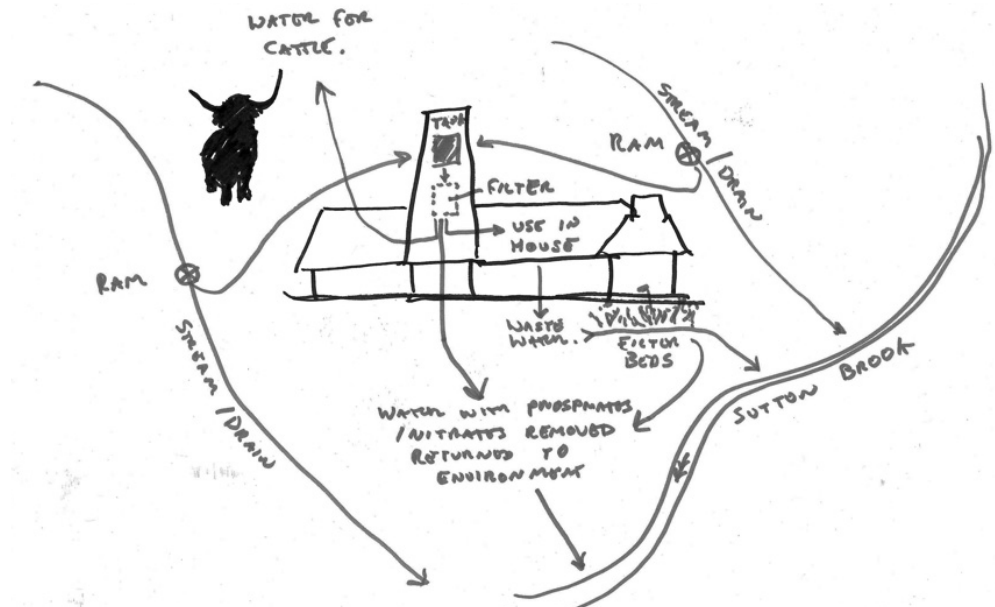
Design Development



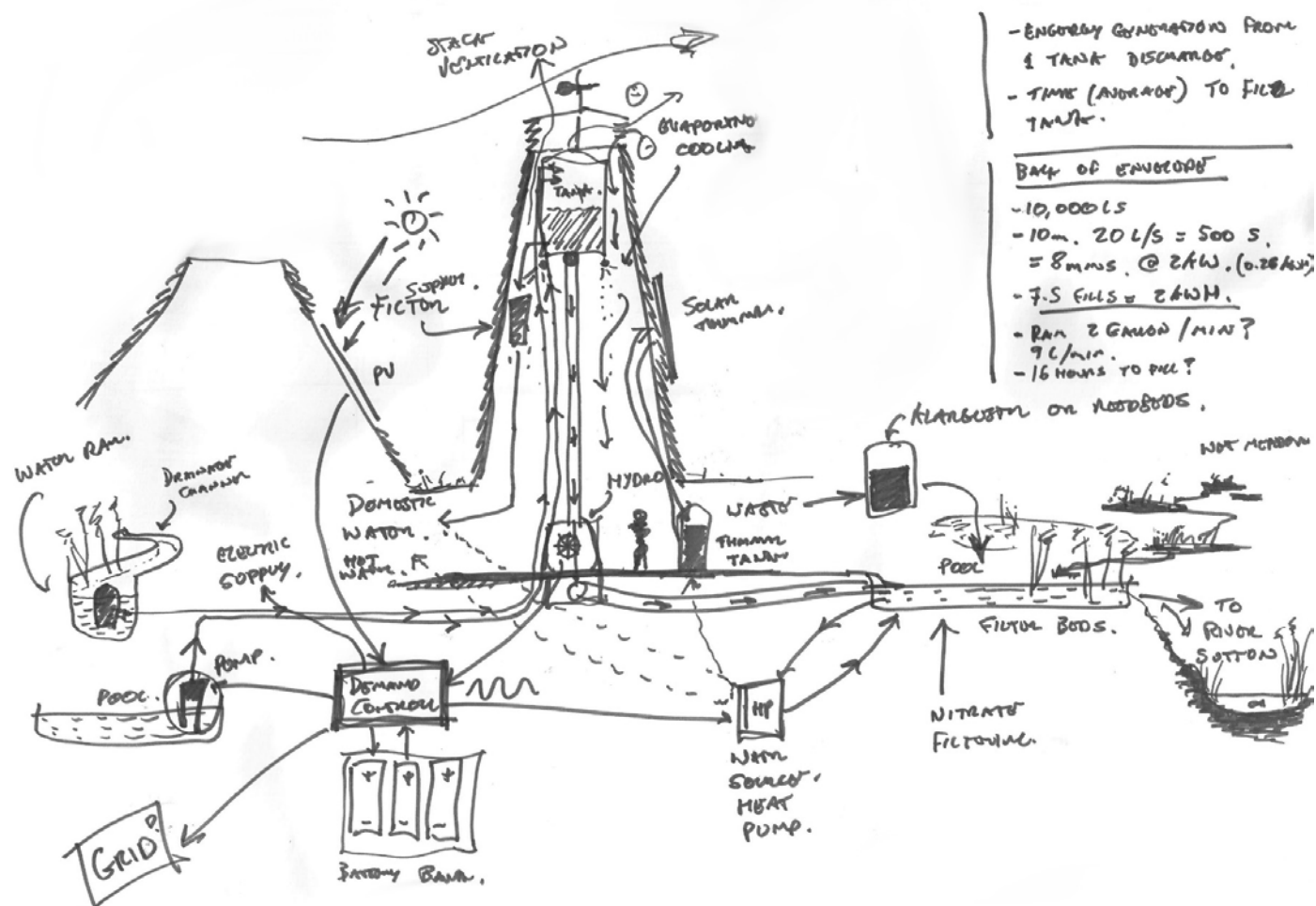




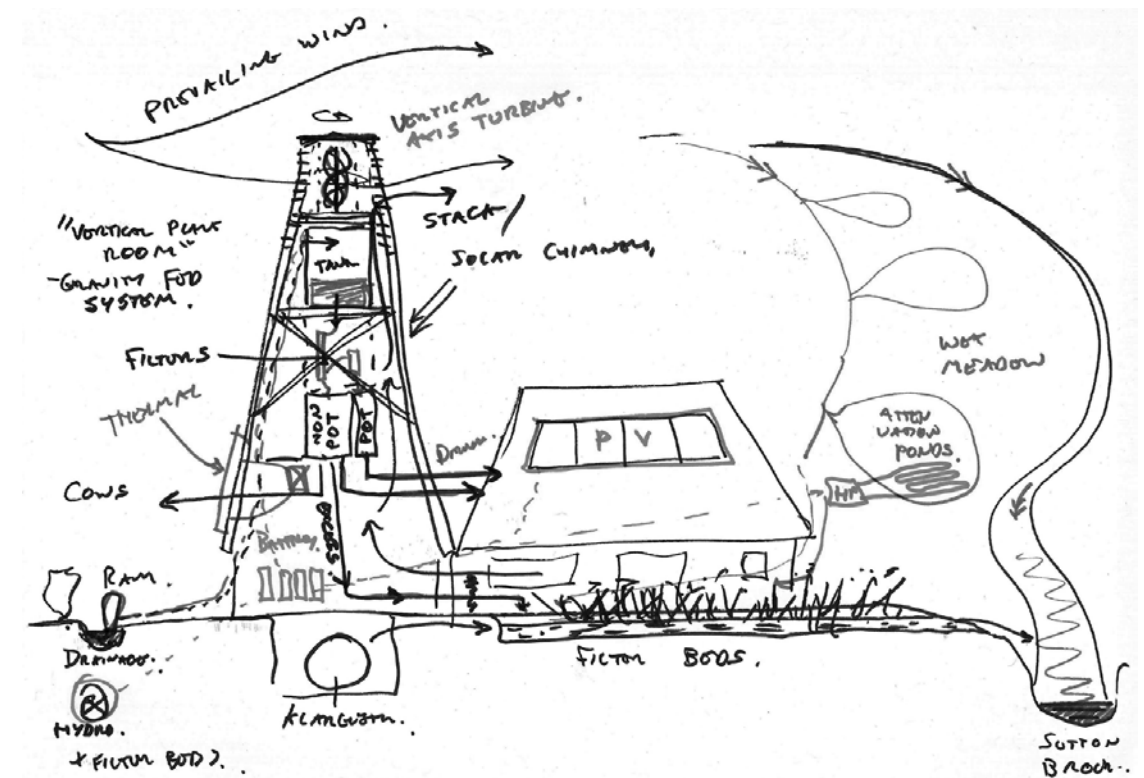
Sketches exploring tower options and functionality



Sketch looking at flows of water on site and the way the building relates to the water ecology of the surrounding landscape.



Initial sketches looking at water and energy systems for an off-grid building and the way that these elements could inter-relate and inform the architectural proposal. Calcs were feasibility scoping on a water based gravity battery.

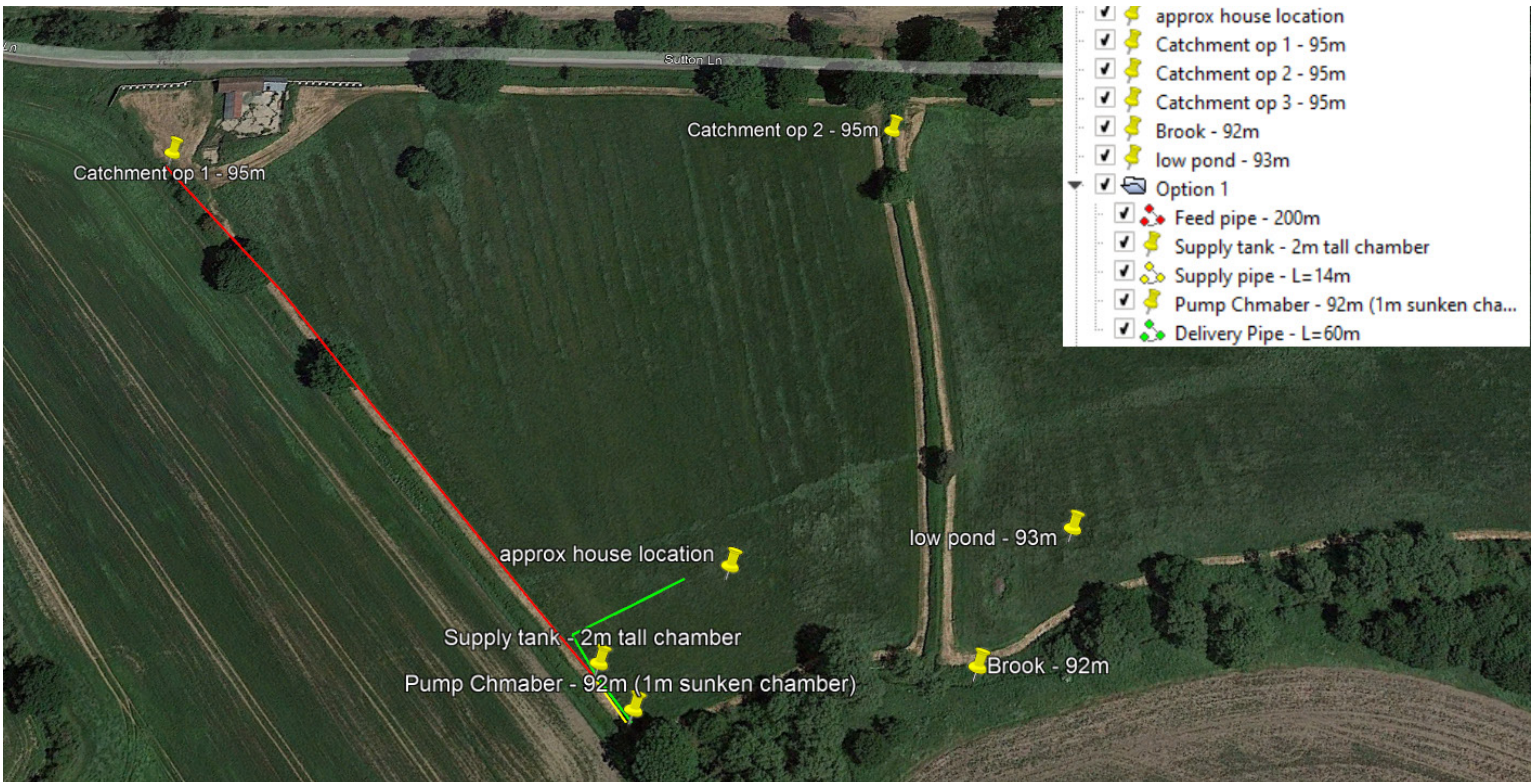
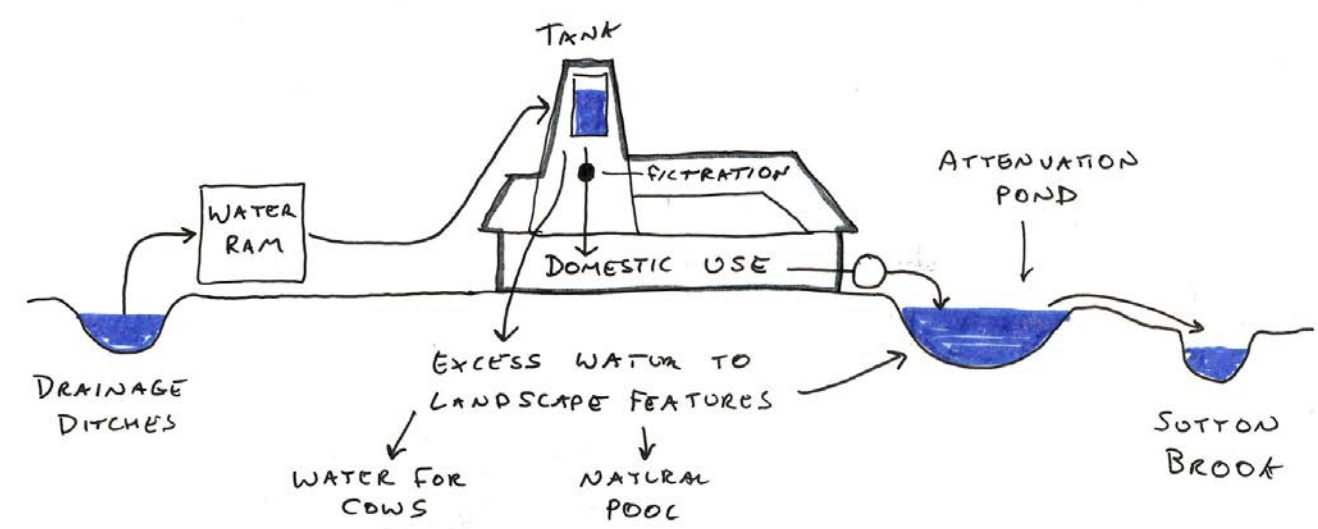


Sketches to explore environmental strategies and the integration of off-grid water and energy systems.

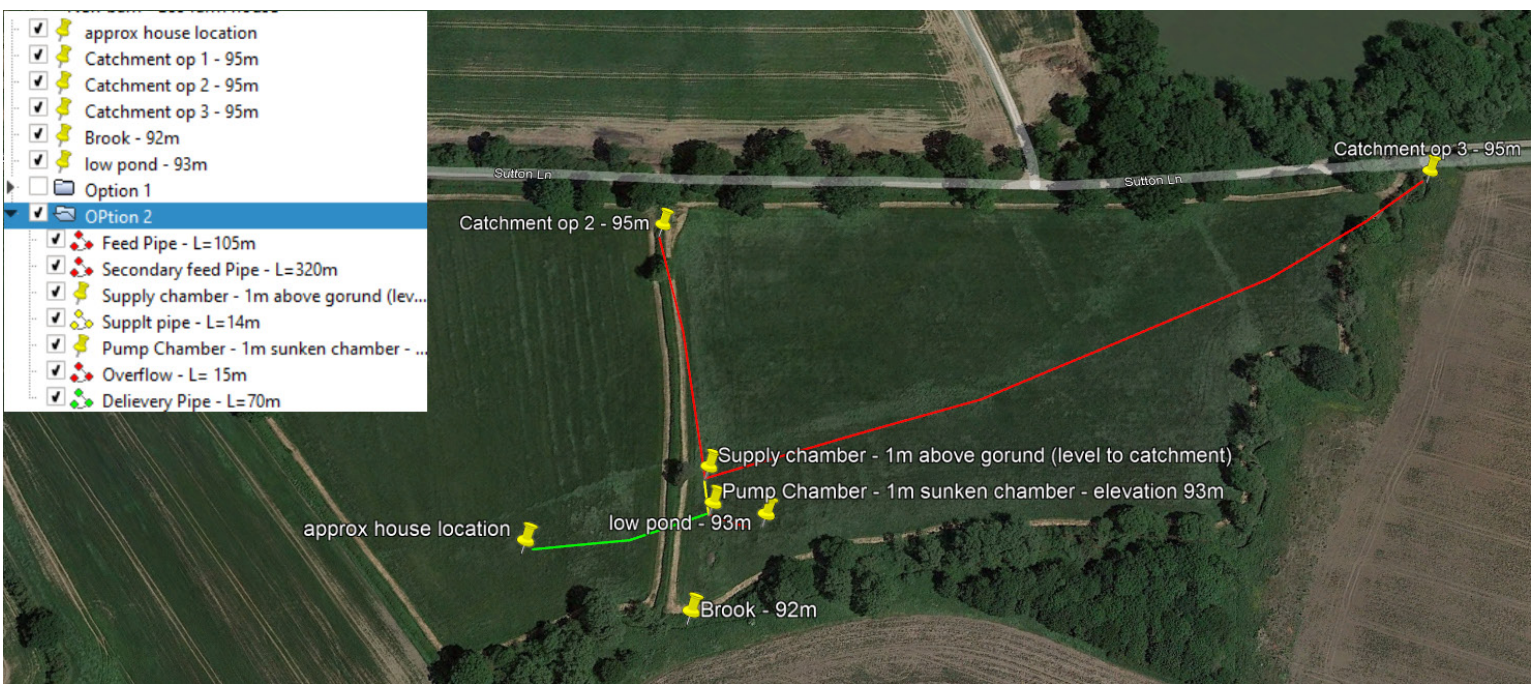
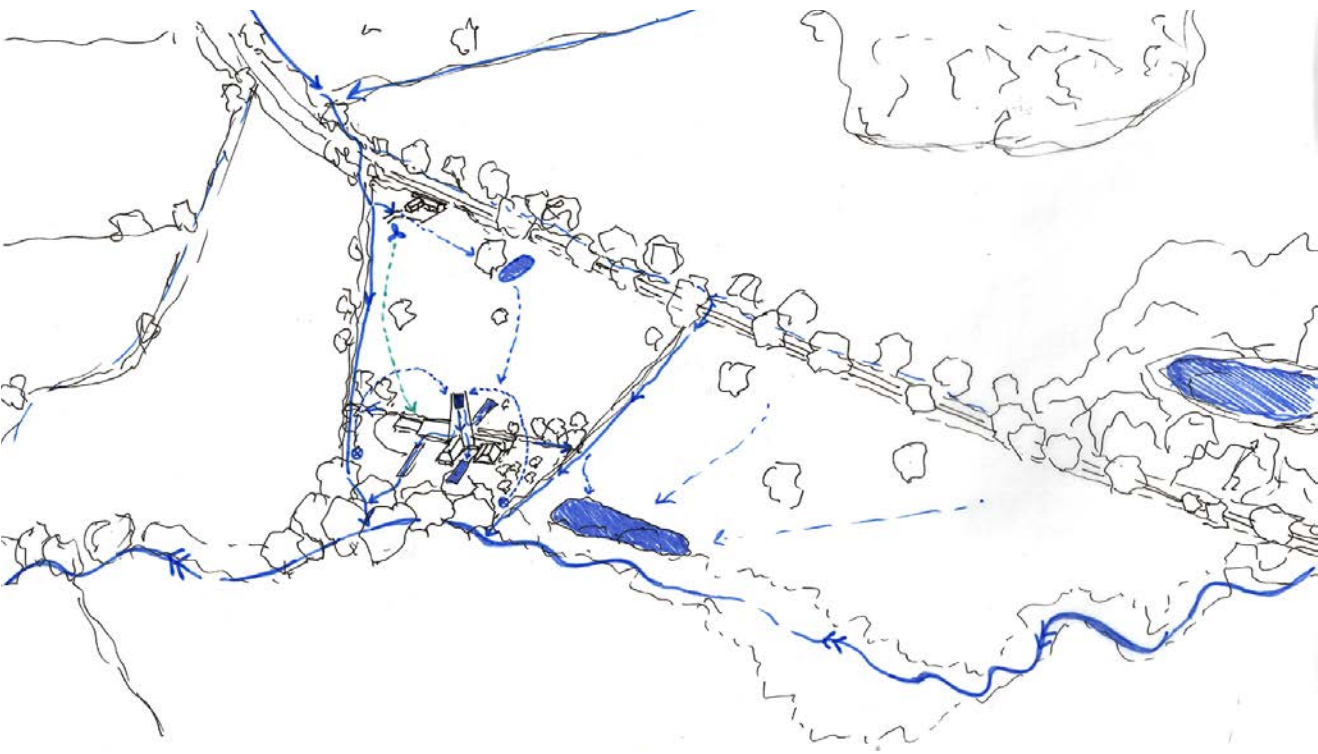


SITE FEASIBILITY STUDY

In order to gauge the feasibility of supplying the house with water collected from surrounding drainage channels, the design team have engaged a specialist supplier Water Powered Technologies. They have undertaken an assessment and come up with some options for arranging the water ram / papa-pump equipment on site, to enable supply to the water tower within the house.



Option 1 - looking at collecting water from the drainage channel running down the east side of site.



Option 2 - looking at collecting water from the drainage channel running through the centre of the site and from Sutton Brook

WATER SAMPLING

A sample of water from drainage ditches on site was sent to a specialist company for analysis. The sample submitted failed the drinking water test on following criteria:

Microbiology	Chemistry
Coliforms	Iron (result 349 ug/l, limit 200)
E. Coli	Manganese (result 117 ug/l, limit 50)

However the company were confident that with the correct approach to filtration, this water can be filtered to a potable standard.

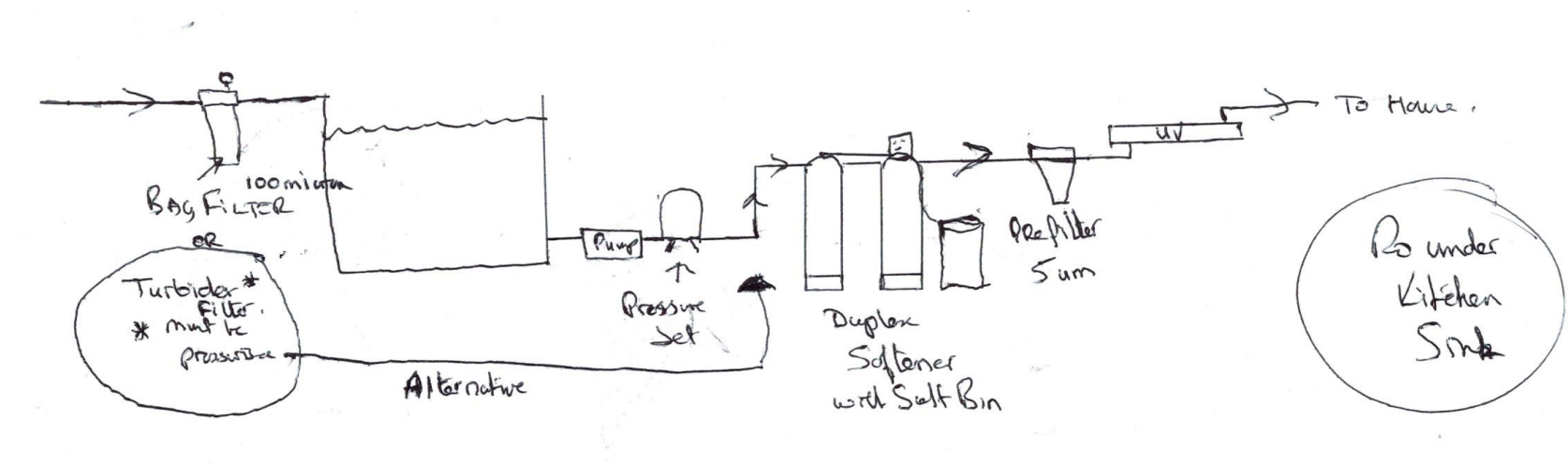


Diagram of filtration process from Wrekin Water

FILTRATION EQUIPMENT

Wrekin Water Filtration have recommended the following equipment in order to filter stream water and run-off to potable quality:

- 1. Pre-Filter for tank storage. PBH Bag filter – 20in version
- 2. Bags - 100 or 200
- 3. Duplex Softener with Low Fouling resin – Recommending 30L.
- 4. Pre-Filter and UV – Ssi55 with HF10BB High flow pre-filter
- 5. Under-sink Reverse Osmosis

WASTE WATER TREATMENT

We propose that waste water from the house (grey/black) be treated by a klargester or 'biobubble', which cleans water to a safe standard. This water would then be released into the large attenuation pond on site.



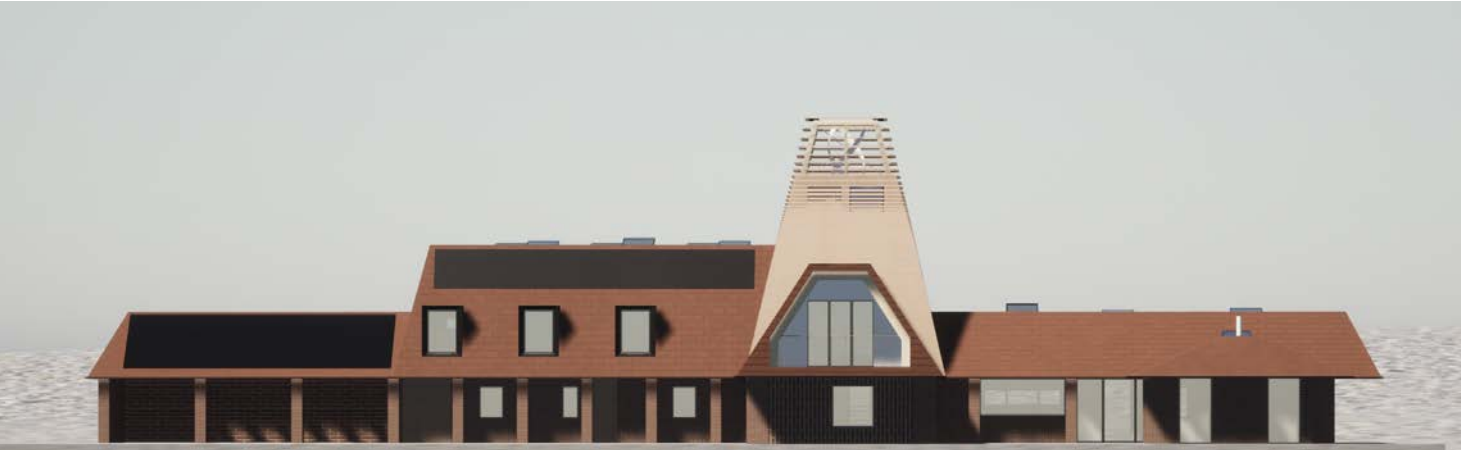
Sketch of semi-private south-facing courtyard with natural pond / pool fed by excess water from tower



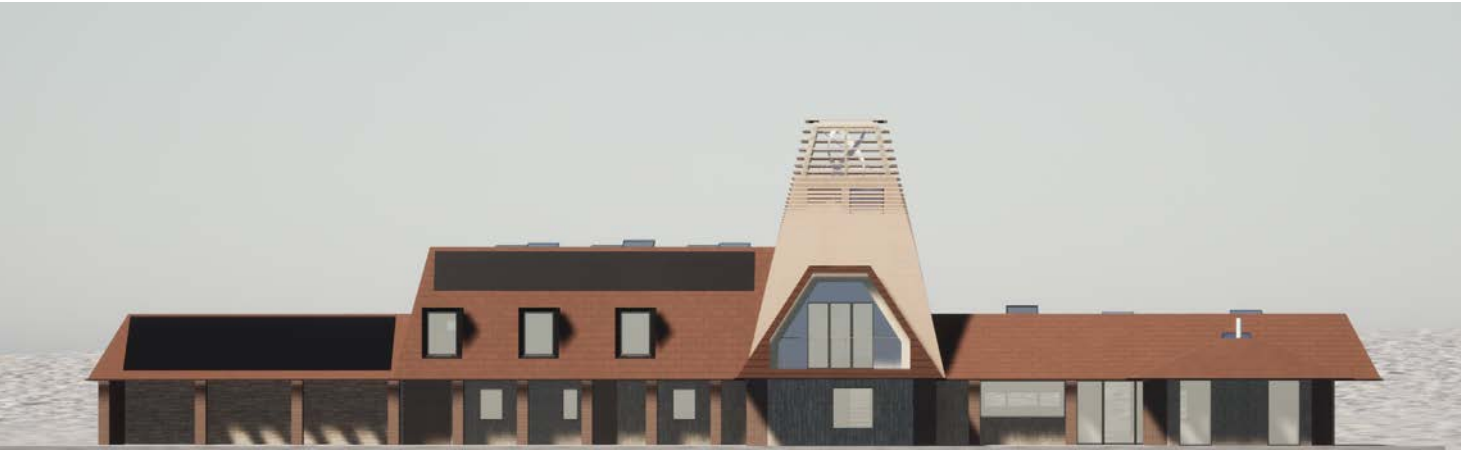
Image of Klargestar tank - self-contained sewage treatment unit



Option 3
Roof: shingles
Walls: limestone
Buttresses: brick



Option 4
Roof: clay tile
Walls: brick
Buttresses: brick



Option 8
Roof: clay tile
Walls: limestone
Buttresses: brick





A



B



C



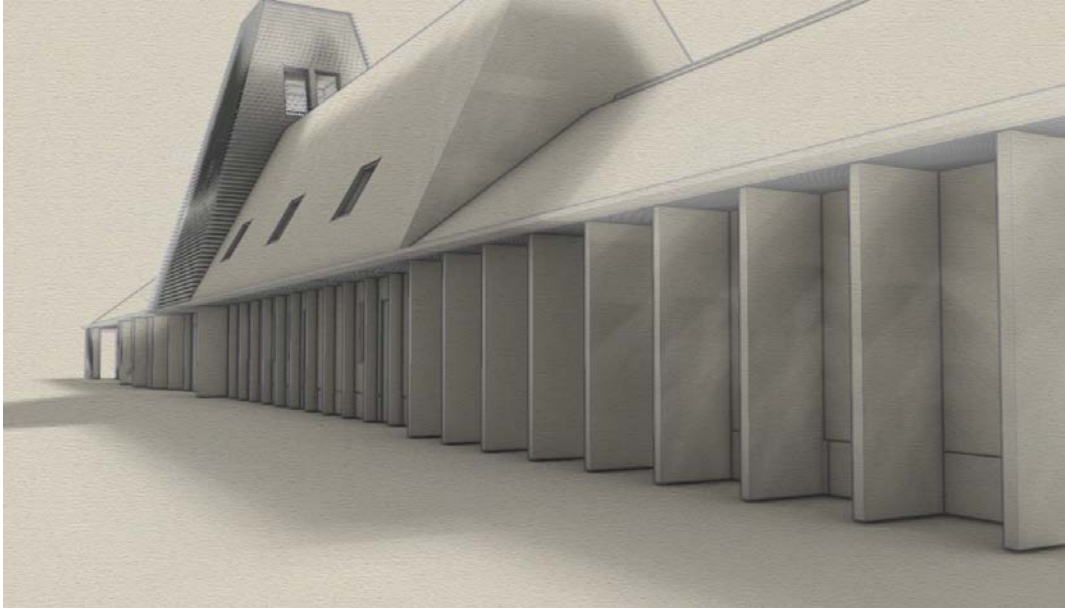
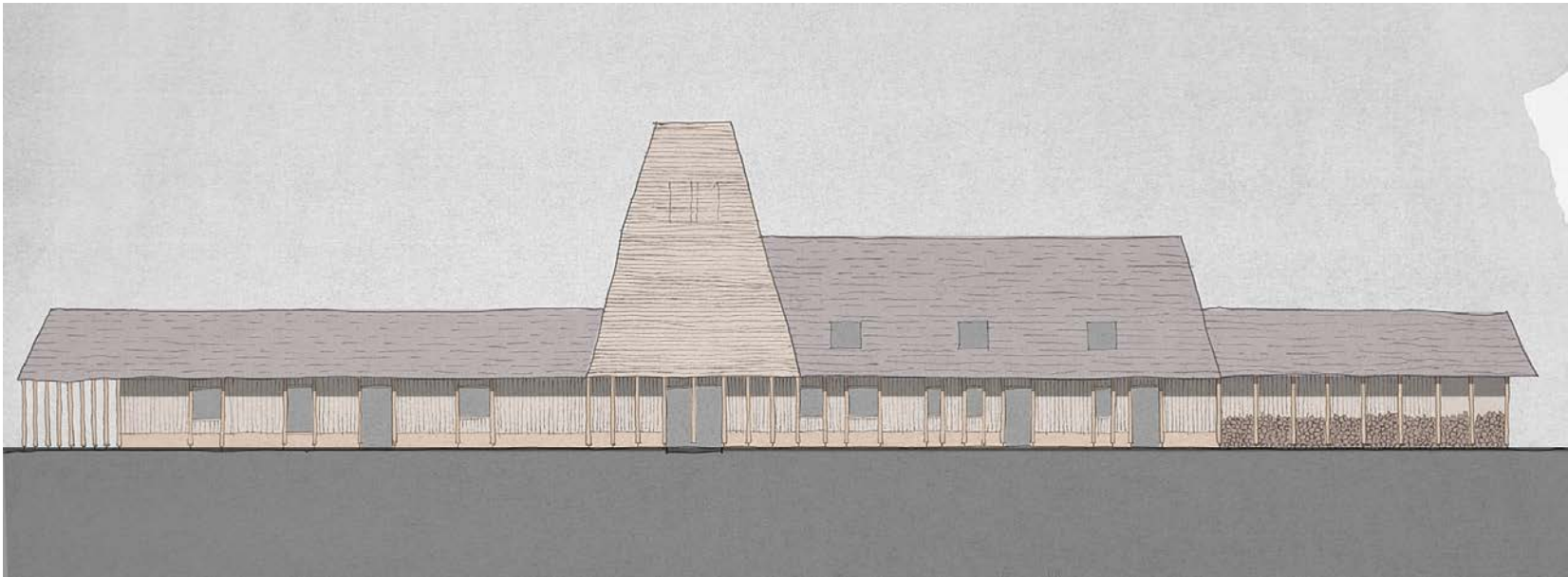
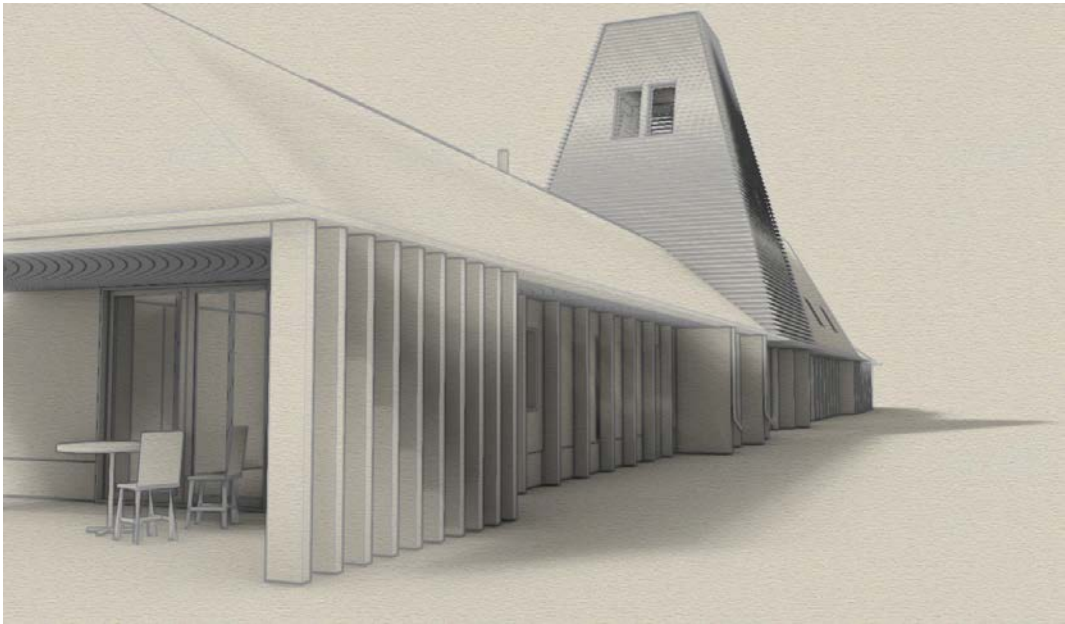
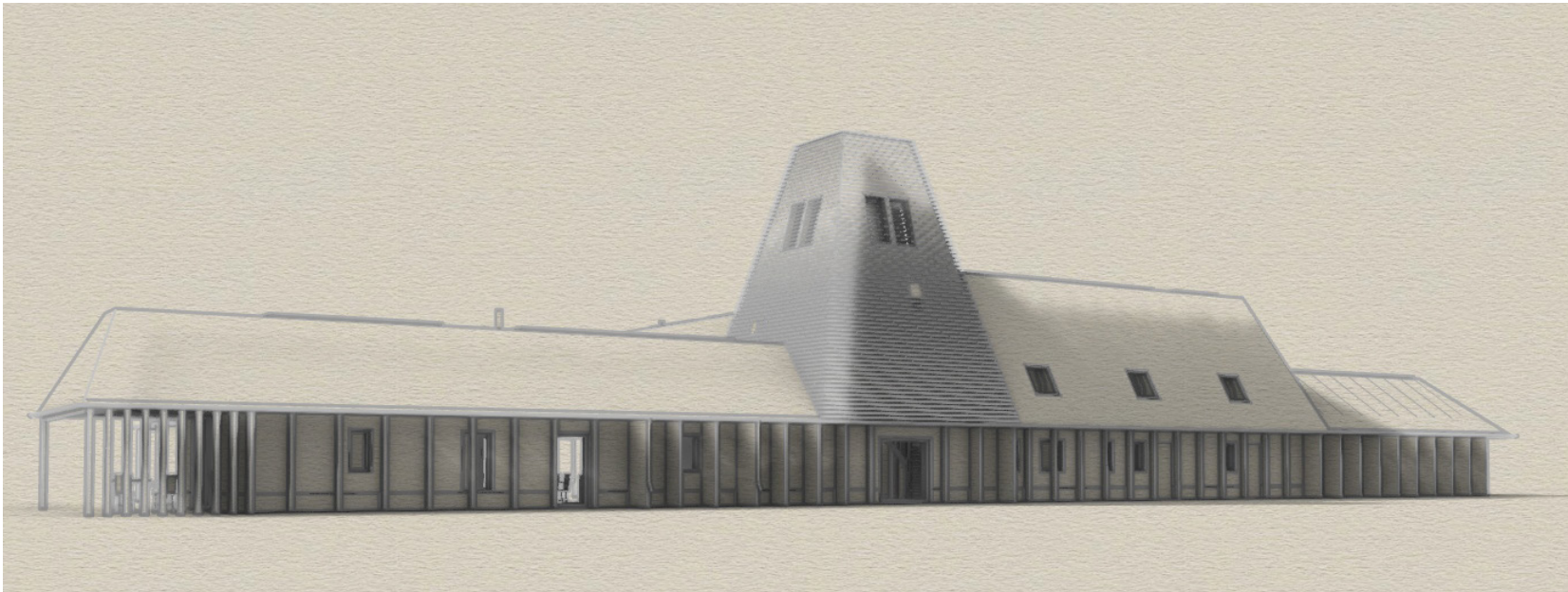
D



E

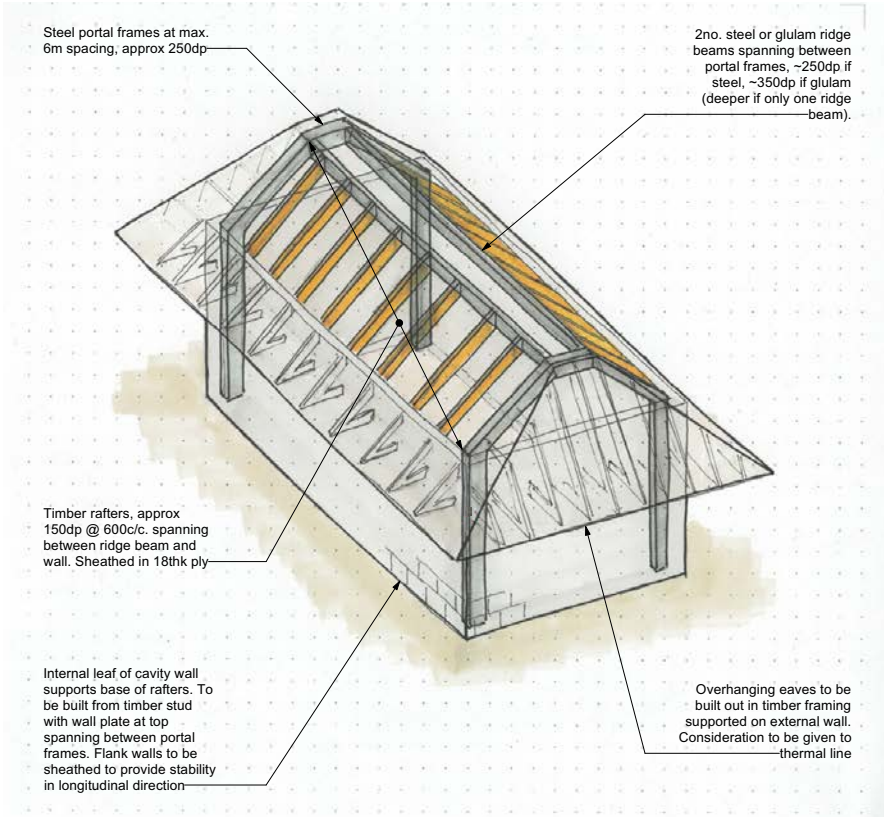


F



Appendix B

Structural Design



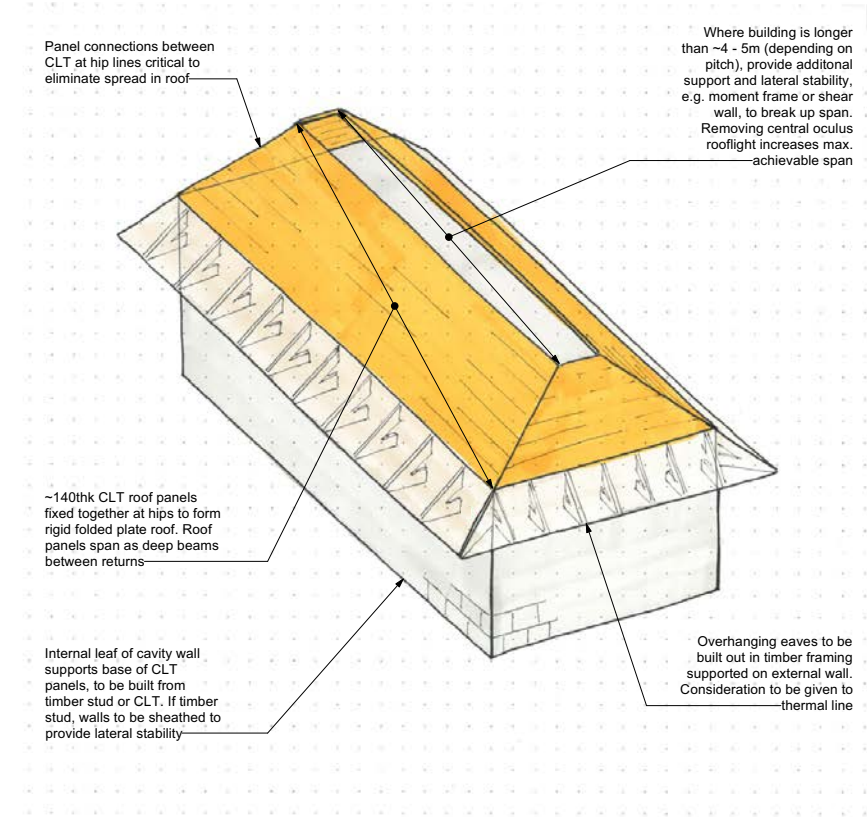
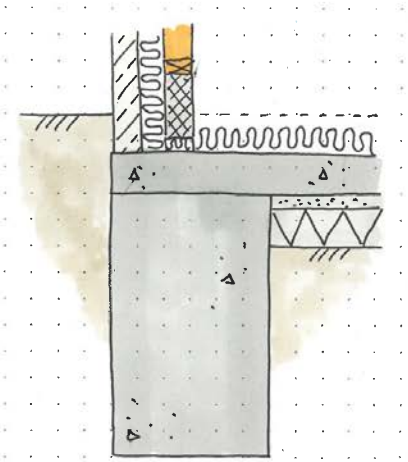
OPTION 1 - STEEL PORTAL FRAME

This option offers a relatively simple/conventional approach for structure. However this is also a high embodied carbon approach and it may be more difficult to detail well for expressed structure.

FOUNDATION OPTIONS

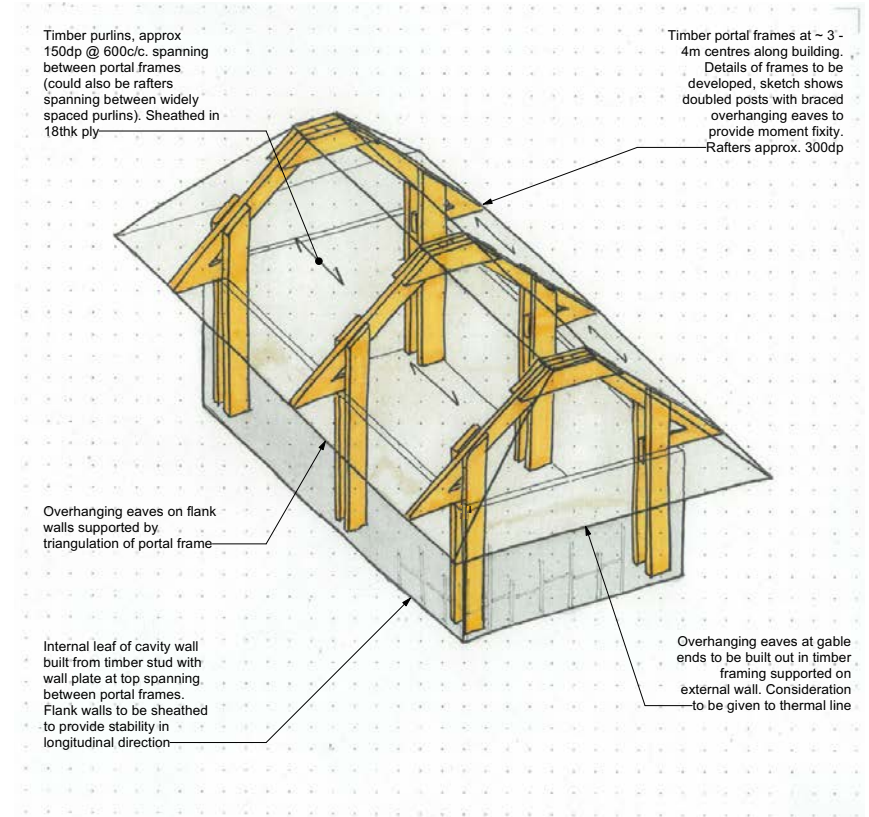
CONVENTIONAL

Mass concrete strip footings with 150thk ground-bearing slab over. Blockwork up-stand for timber stud internal leaf



OPTION 2 - CLT

Cross laminated timber offers a lower-carbon option and integrated approach to creating these hipped roof forms. However, this is an expensive option with long lead times and supply chain challenges. This option would require a specialist contractor.



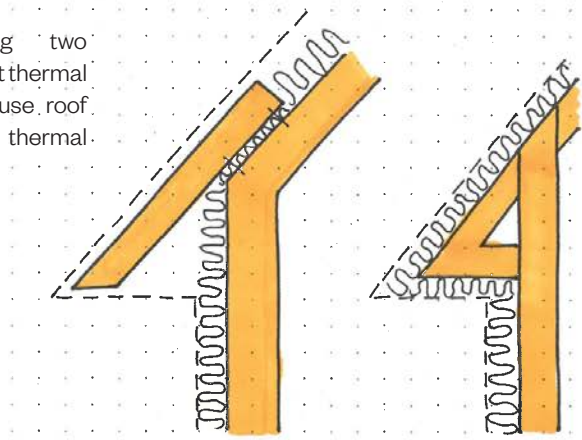
OPTION 3 - TIMBER PORTAL FRAMES

This option offers a cheaper solution than CLT and would be the lowest embodied carbon approach. Key challenges exist around eaves detailing and lateral stability (discussed further on the following pages).

TIMBER FRAME OPTIONS

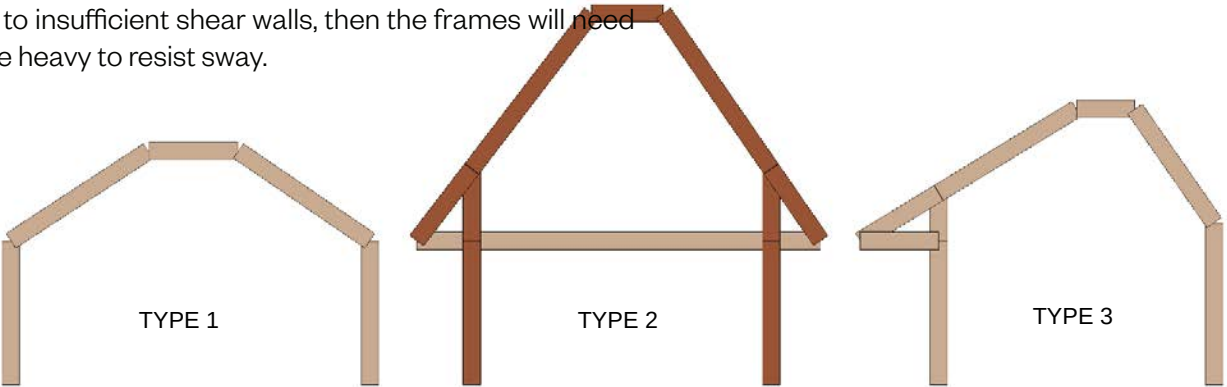
THERMAL BRIDGING

Sketch details showing two approaches to designing-out thermal bridging in the Breach House roof to ensure continuity of thermal envelope.



TIMBER PORTAL FRAME OPTIONEERING

The studies below were undertaken by structure workshop to further explore the option of a timber portal frame approach, looking at the impact of spacing and initial sizing of structural members. If the timber portal frames have to be designed to resist wind load due to insufficient shear walls, then the frames will need to be heavy to resist sway.



- PINNED BASES
- RIGID EAVES AND RIDGE CONNECTIONS
- OVERHANGING EAVES FORMED WITH CANTILEVERING "SPROCKETS"
- PINNED BASES
- OVERHANGING EAVES FORMED AS PART OF FRAME CREATING RIGID EAVES CONNECTION
- RIGID RIDGE CONNECTION
- PINNED BASES
- OVERHANGING EAVES FORMED AS PART OF FRAME CREATING RIGID EAVES CONNECTION ON ONE SIDE
- RIGID EAVES CONNECTION ON SIDE WITH SMALLER OVERHANG
- RIGID RIDGE CONNECTION

PRELIMINARY SIZES

2.4m CENTRES

- 2no. 160 x 320 GL24
- 160 x 320 GL24

1.2m CENTRES

- 2no. 100 x 300 C24
- 100 x 300 C24

0.6m CENTRES

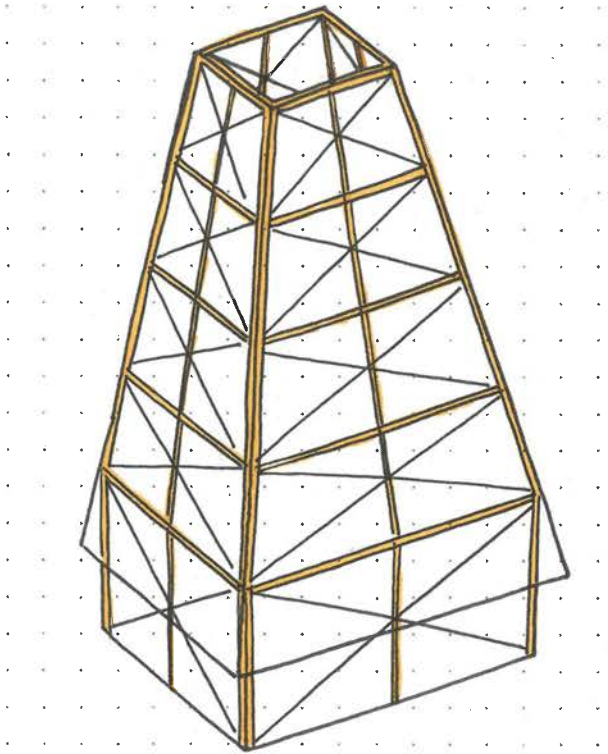
- 2no. 100 x 250 C24
- 100 x 250 C24



MATERIAL VOLUME INCREASES WITH THE NARROWER SPACING

TOWER OPTION 1 - BRACED TIMBER LATTICE

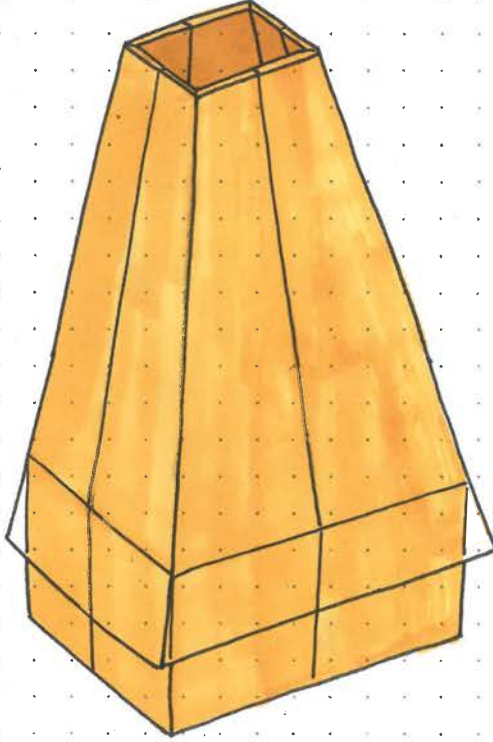
Braced timber frame to outer skin of tower. Structural line begins vertically. Can accommodate internal floors.



Cooling Tower (Bernd and Hilla Becher)

TOWER OPTION 2 - CLT

CLT tower with vertically oriented panels. Structural line begins vertically. Would make sense as a consistent approach if CLT was proposed for the whole building



CLT lift core (SmartLam)

TIMBER PORTAL FRAME OPTIONEERING

If there are sufficient shear walls to provide lateral stability then the frames can be slimmer.

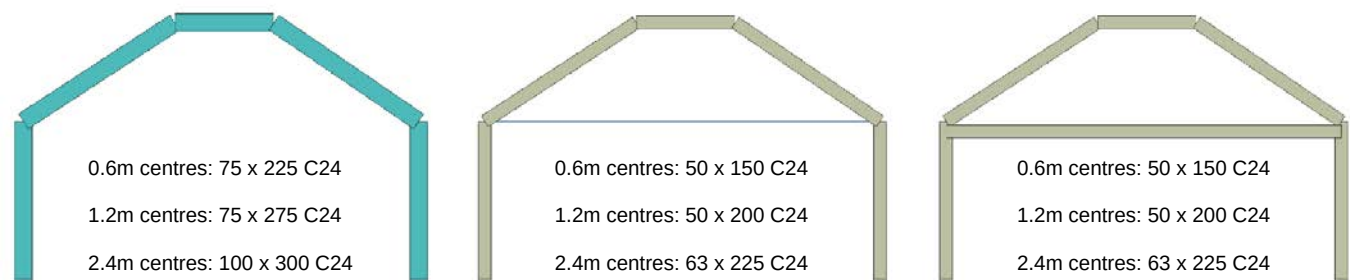
Shear walls would ideally be:

- At the gable ends
- No greater than 10m apart
- At least 2.5m long

A continuous eaves beam and ring beam around the roof light is necessary. Providing a tie will help reduce spread and lead to even smaller frames. The mark-up below from the engineer shows ideal locations for shear walls:



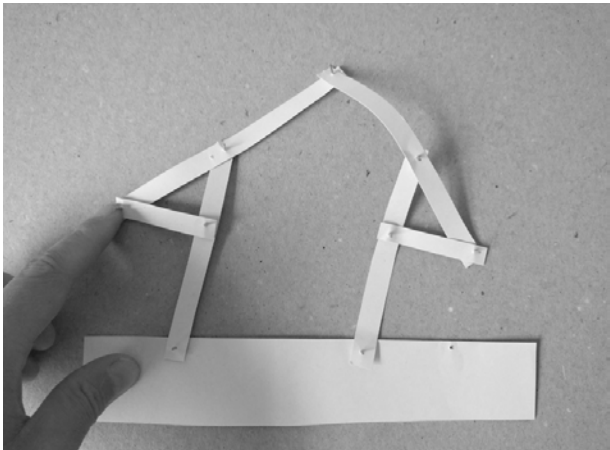
IDEAL LOCATION OF WALLS TO AVOID HEAVY TIMBER PORTAL FRAMES



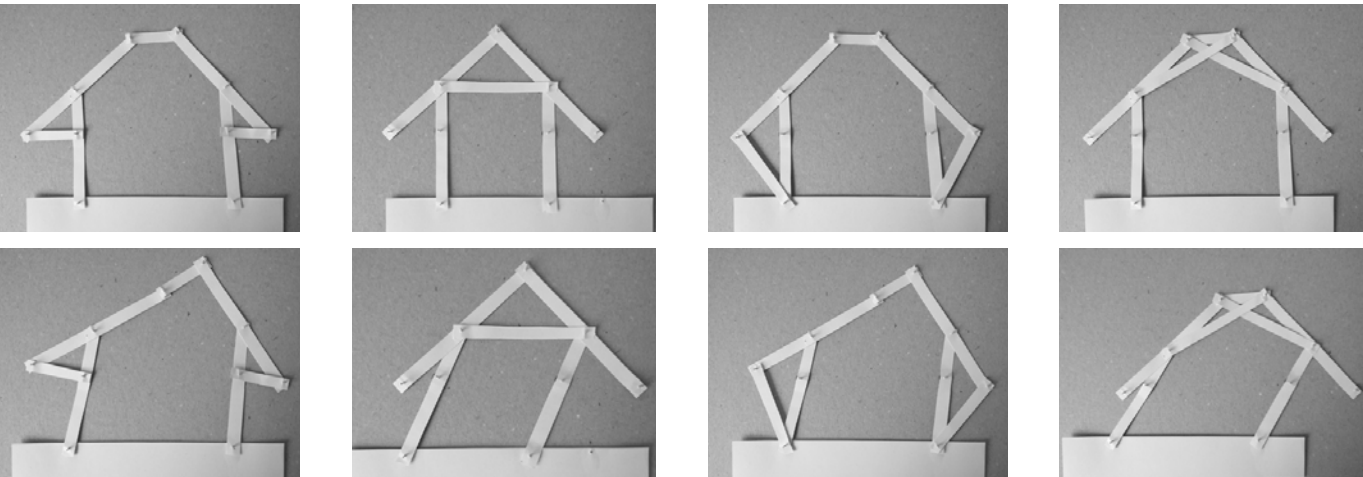
APPROXIMATE SIZES OF FRAMES REQUIRED IF SHEAR WALLS ARE ADEQUATE

TRUSS CONFIGURATIONS

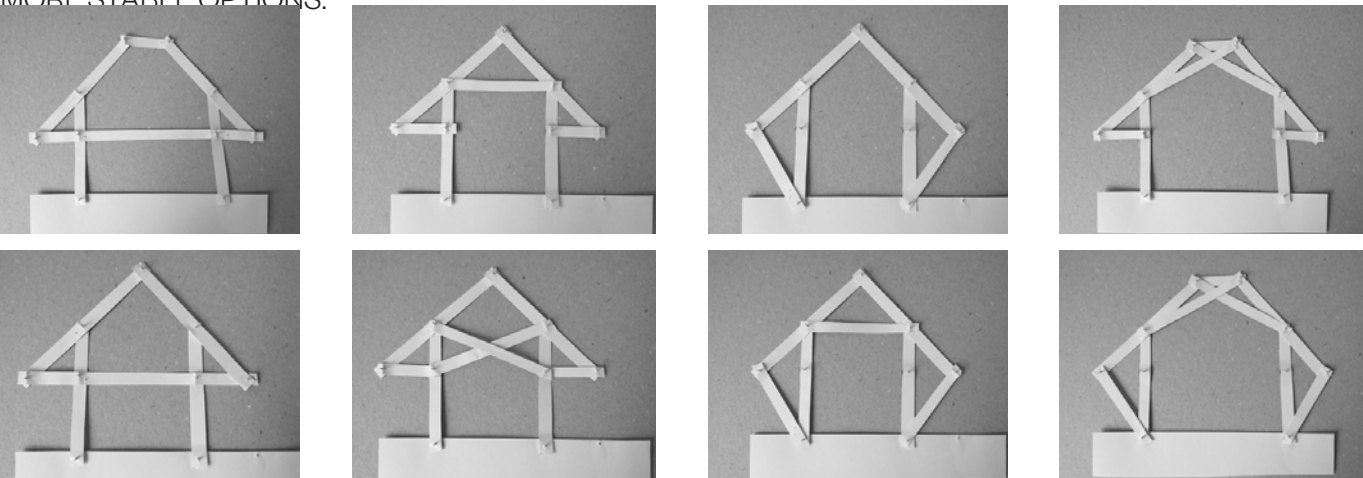
A series of simple paper and pin models were constructed to test the rigidity of different truss configurations. Each joint is freely rotating and so these models provide a simple test for whether an arrangement will be rigid without the use of moment-resisting joints/connections.



LESS STABLE OPTIONS:



MORE STABLE OPTIONS:

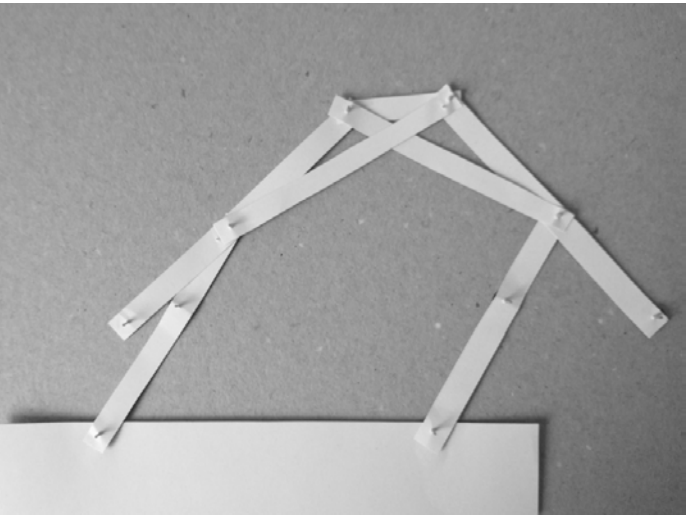


A KEY STRUCTURAL CHALLENGE

A key question that has arisen during this initial period of structural optioneering and feasibility work, is the question of shear wall and resisting lateral loads (such as wind loading). The problem is well illustrated by model photo below. A cross braced roof structure arrangement may be rigid and stable within itself, but when sat atop parallel walls, the whole arrangement is want to ‘parallelogram’.

In the absence of sufficient shear walls, the structural members will need to be heavy, with a relatively high degree of redundancy and moment connections in order to resist such loads.

At the same time there is a basic incompatibility between having regular shear walls and the open-plan intent of the architectural and spatial aspiration of the project. This lead to the search for some alternative approaches to this question. 4 options that were explored are illustrated here with images from a digital model.

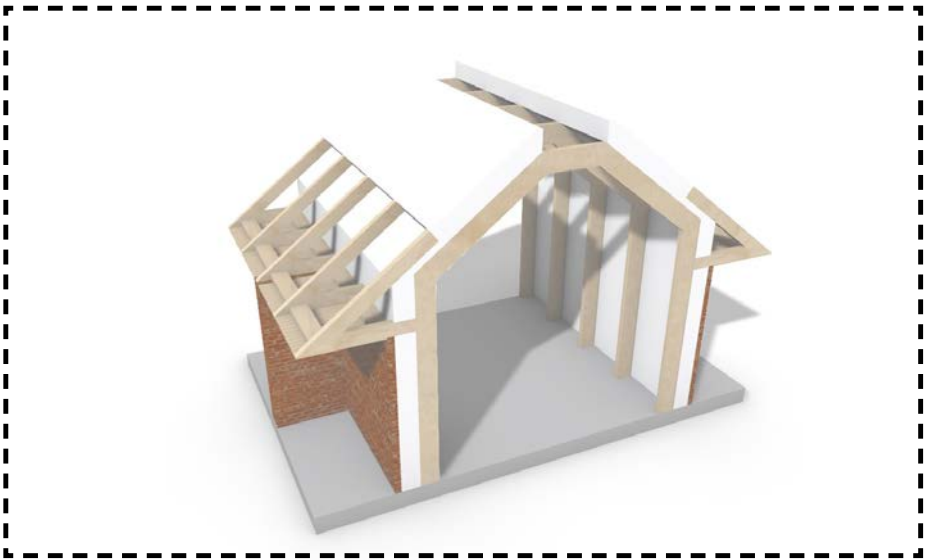


Simple pin and paper model - rigid roof form, but unresistant to lateral loads overall.



OPTION 1 - SHEAR WALLS AS SPECIFIED BY ENGINEER

The problem with this option is that it would involve breaking the interior spaces up. This would mean that we don't achieve the generous long-span volumes originally envisioned. In terms of being 'long life, loose fit and low carbon' this option would also be less good as the building will be less flexible to adaptation over time.



OPTION 3 - BUTTRESSES WITH INTERIOR TRUSSES

Exterior buttress elements could perform a similar job to interior shear walls, while allowing for open-plan interior space. A key challenge to address here will be thermal bridging between buttress and interior roof truss structure. We may be able to use an Ancon Teplo-L-Tie for instance which has good thermal performance. If a stronger connection is required, this could be done in steel but with a thermal break pad between the steel and timber.

At this point in the project we have elected to pursue this strategy as it seems to offer a means of addressing the question of lateral stability without over-specifying structural members or compromising on interior space. In addition the design team feel that the buttress could be an interesting element of the architectural language, which could have additional functionality, and nod towards older agricultural typologies such as the Tithe Barn (many of which are buttressed).



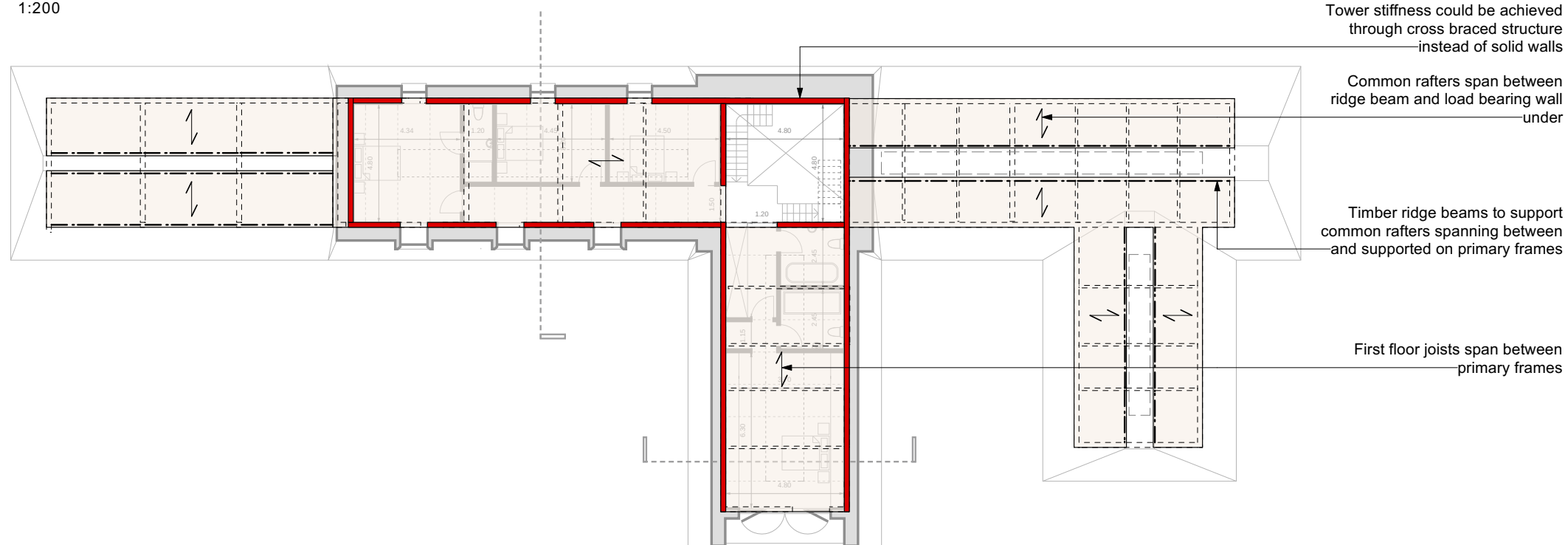
OPTION 2 - EXTERIOR CROSS BRACING

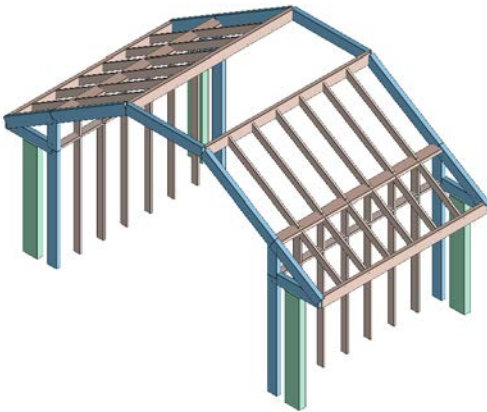
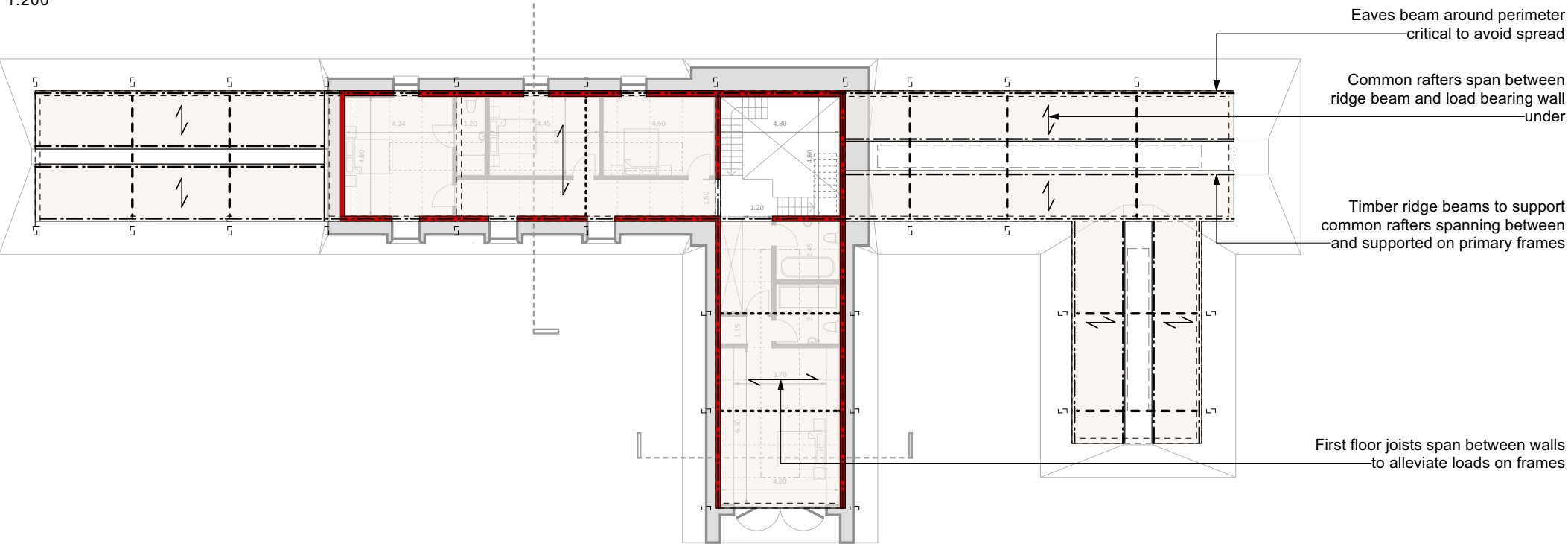
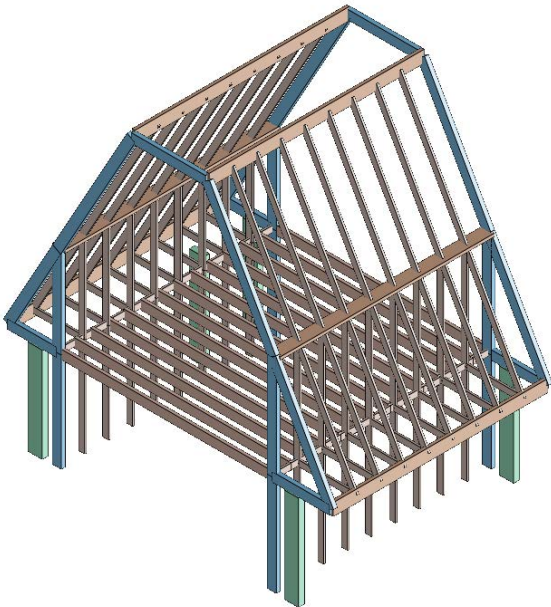
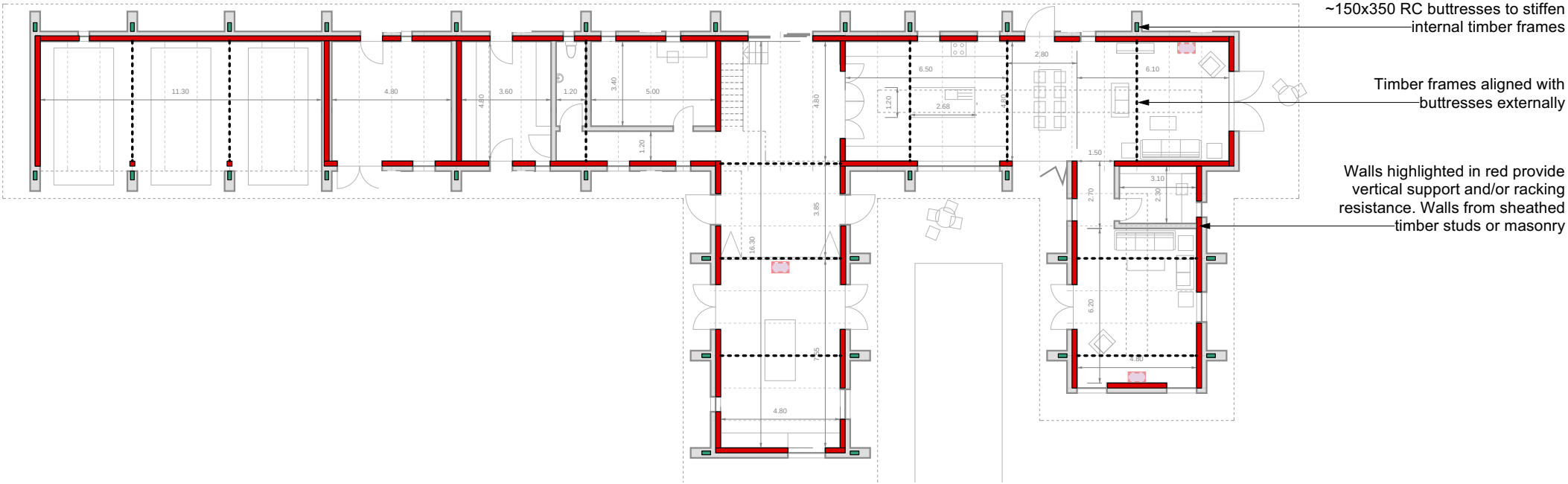
External cross-braced bays could be used within the sheltered 'overhang zones' to give lateral rigidity to the arrangement. It would be relatively easy to achieve a thermal break and the cross braced language could create continuity between interior and exterior.



OPTION 4 - BUTTRESSES WITH EXTERIOR 'COLD STRUCTURE'

Another solution to remove thermal bridging could be keeping all the timber structure "cold" ie outside of the thermal envelope- however this does mean that it performs less well structurally. This may lead to bigger sizes to keep deflection within limits. Shrinkage and movement will also be greater given that the structural will experience more temperature change.

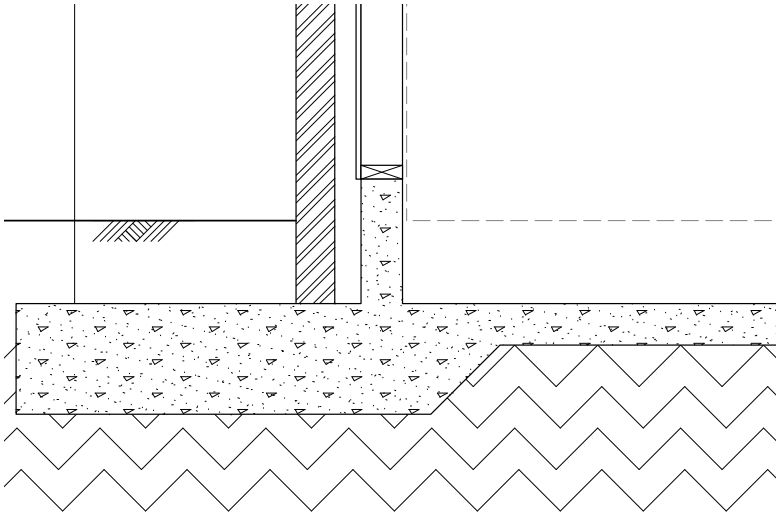
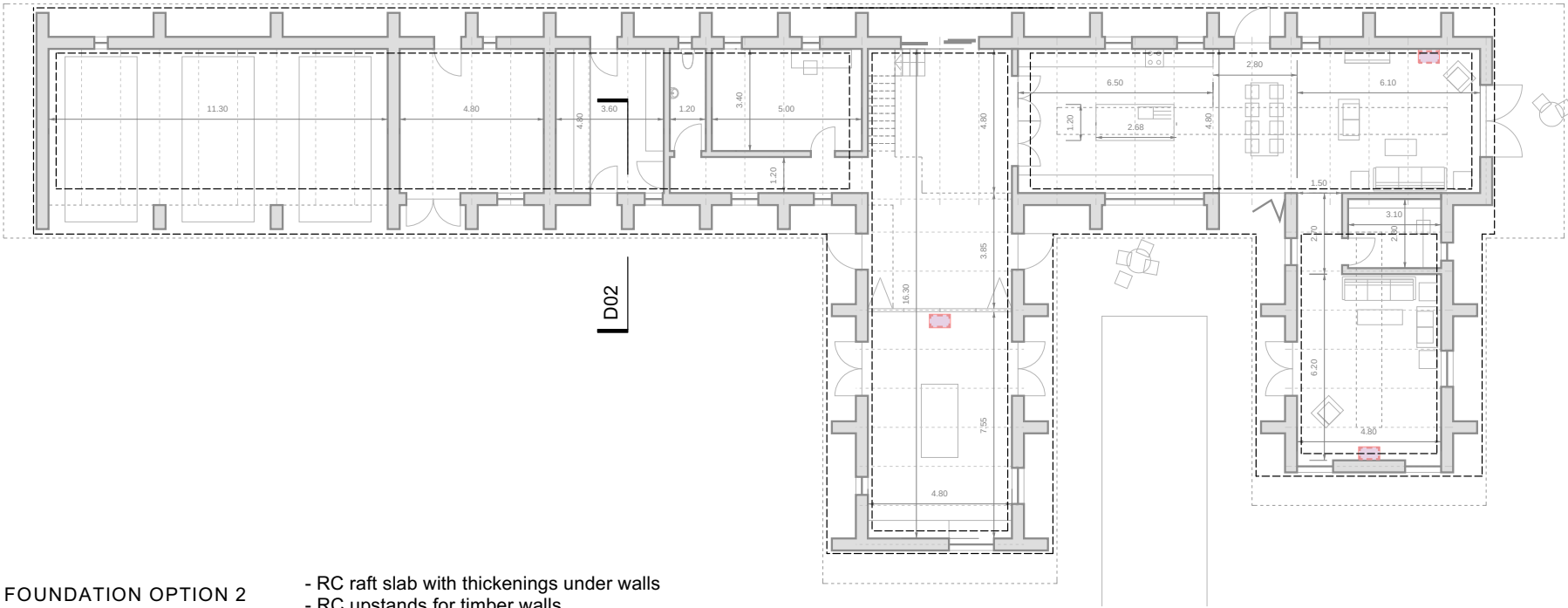
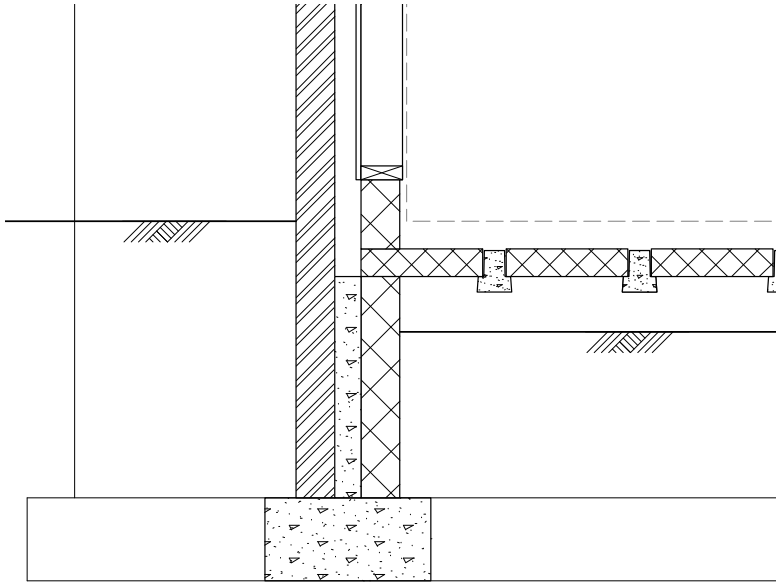
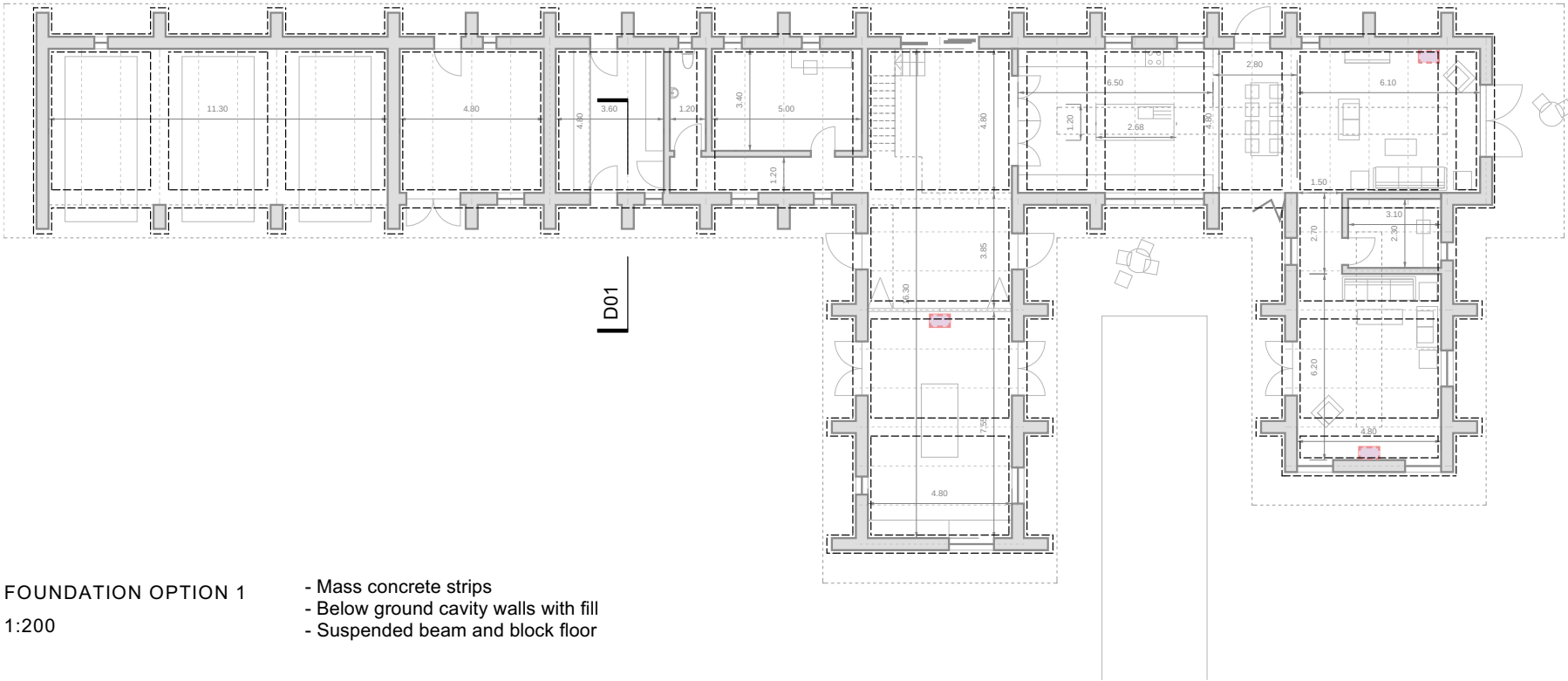


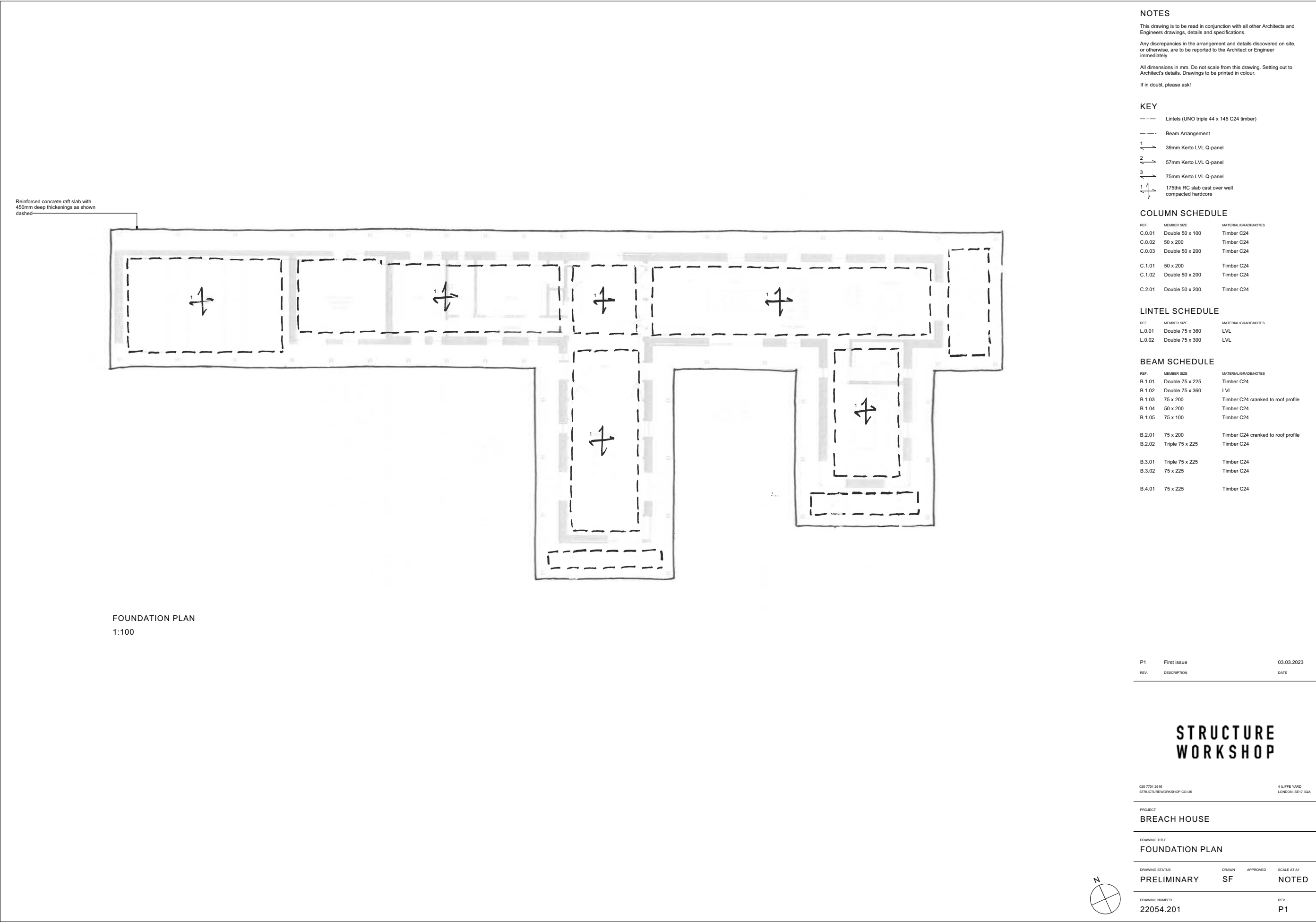


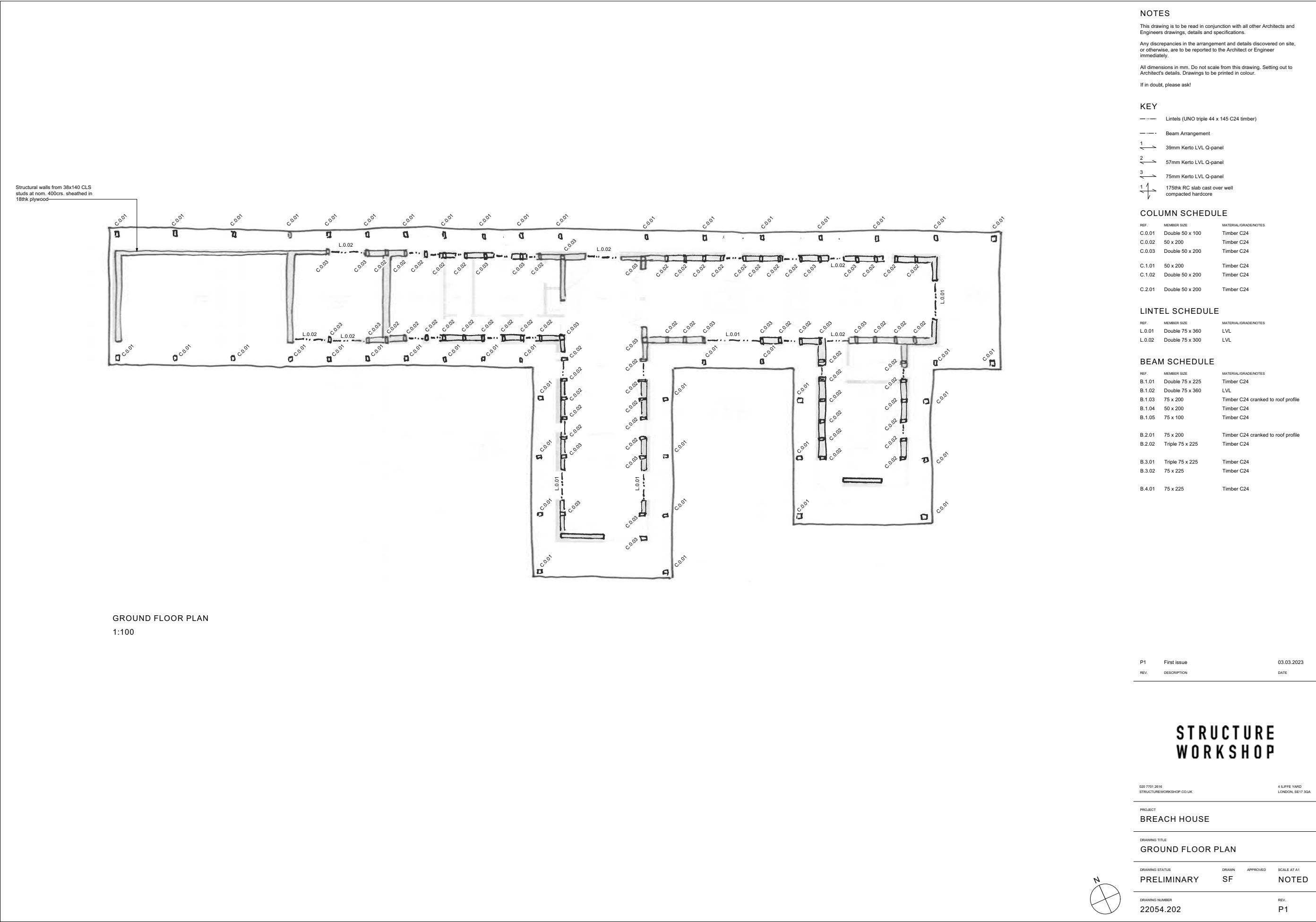
STRUCTURE
WORKSHOP

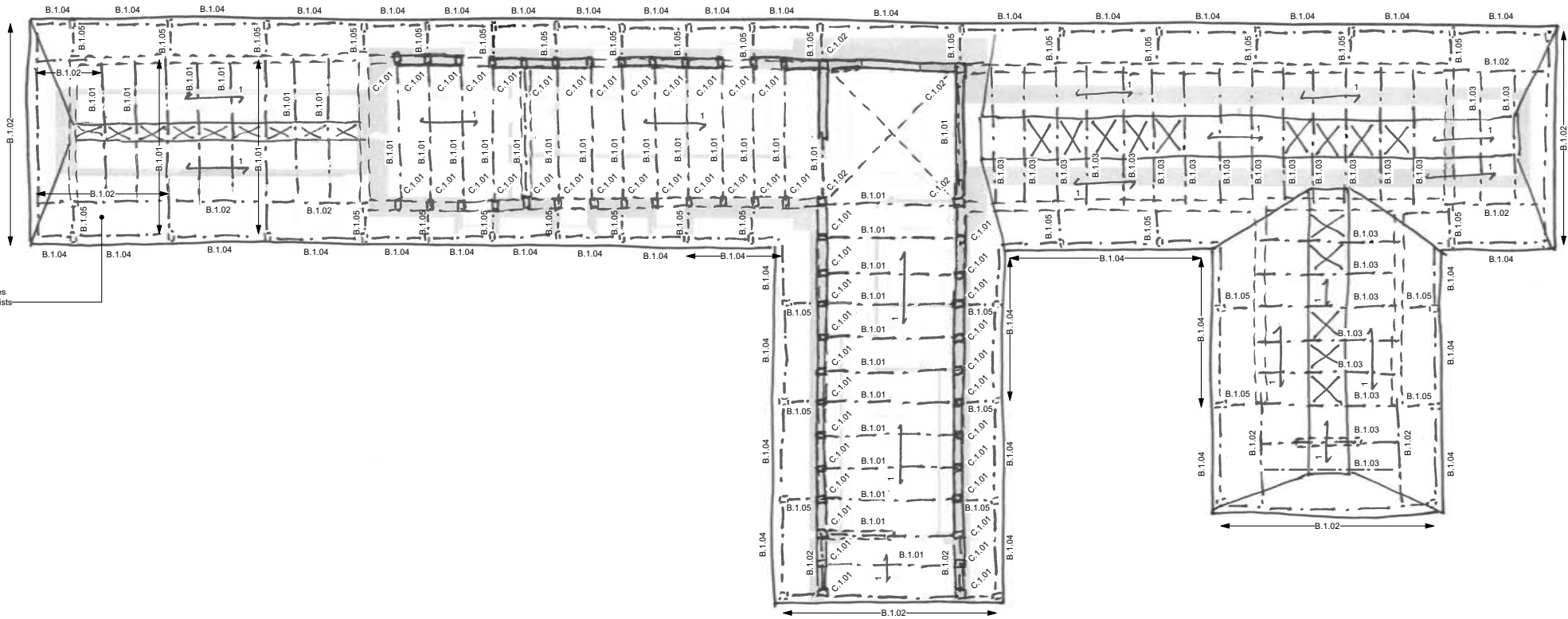
PROJECT BREACH HOUSE
TITLE SUPERSTRUCTURE OPTION 2

PROJECT NO. 22054 DATE 09.01.23
SHEET NO. SK11 ENG SF









FIRST FLOOR PLAN
1:100

NOTES

This drawing is to be read in conjunction with all other Architects and Engineers drawings, details and specifications.

Any discrepancies in the arrangement and details discovered on site, or otherwise, are to be reported to the Architect or Engineer immediately.

All dimensions in mm. Do not scale from this drawing. Setting out to Architect's details. Drawings to be printed in colour.

If in doubt, please ask!

KEY

- Lintels (UNO triple 44 x 145 C24 timber)
- Beam Arrangement
- 1 39mm Kerto LVL Q-panel
- 2 57mm Kerto LVL Q-panel
- 3 75mm Kerto LVL Q-panel
- 1 175thk RC slab cast over well compacted hardcore

COLUMN SCHEDULE

REF.	MEMBER SIZE	MATERIAL/GRADE/NOTES
C.0.01	Double 50 x 100	Timber C24
C.0.02	50 x 200	Timber C24
C.0.03	Double 50 x 200	Timber C24
C.1.01	50 x 200	Timber C24
C.1.02	Double 50 x 200	Timber C24
C.2.01	Double 50 x 200	Timber C24
C.3.01	Double 50 x 200	Timber C24

LINTEL SCHEDULE

REF.	MEMBER SIZE	MATERIAL/GRADE/NOTES
L.0.01	Double 75 x 360	LVL
L.0.02	Double 75 x 300	LVL

BEAM SCHEDULE

REF.	MEMBER SIZE	MATERIAL/GRADE/NOTES
B.1.01	Double 75 x 225	Timber C24
B.1.02	Double 75 x 360	LVL
B.1.03	75 x 200	Timber C24 cranked to roof profile
B.1.04	50 x 200	Timber C24
B.1.05	75 x 100	Timber C24
B.2.01	75 x 200	Timber C24 cranked to roof profile
B.2.02	Triple 75 x 225	Timber C24
B.3.01	Triple 75 x 225	Timber C24
B.3.02	75 x 225	Timber C24
B.4.01	75 x 225	Timber C24

P1	First issue	03.03.2023
REV.	DESCRIPTION	DATE

STRUCTURE
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LONDON, SE17 3QA

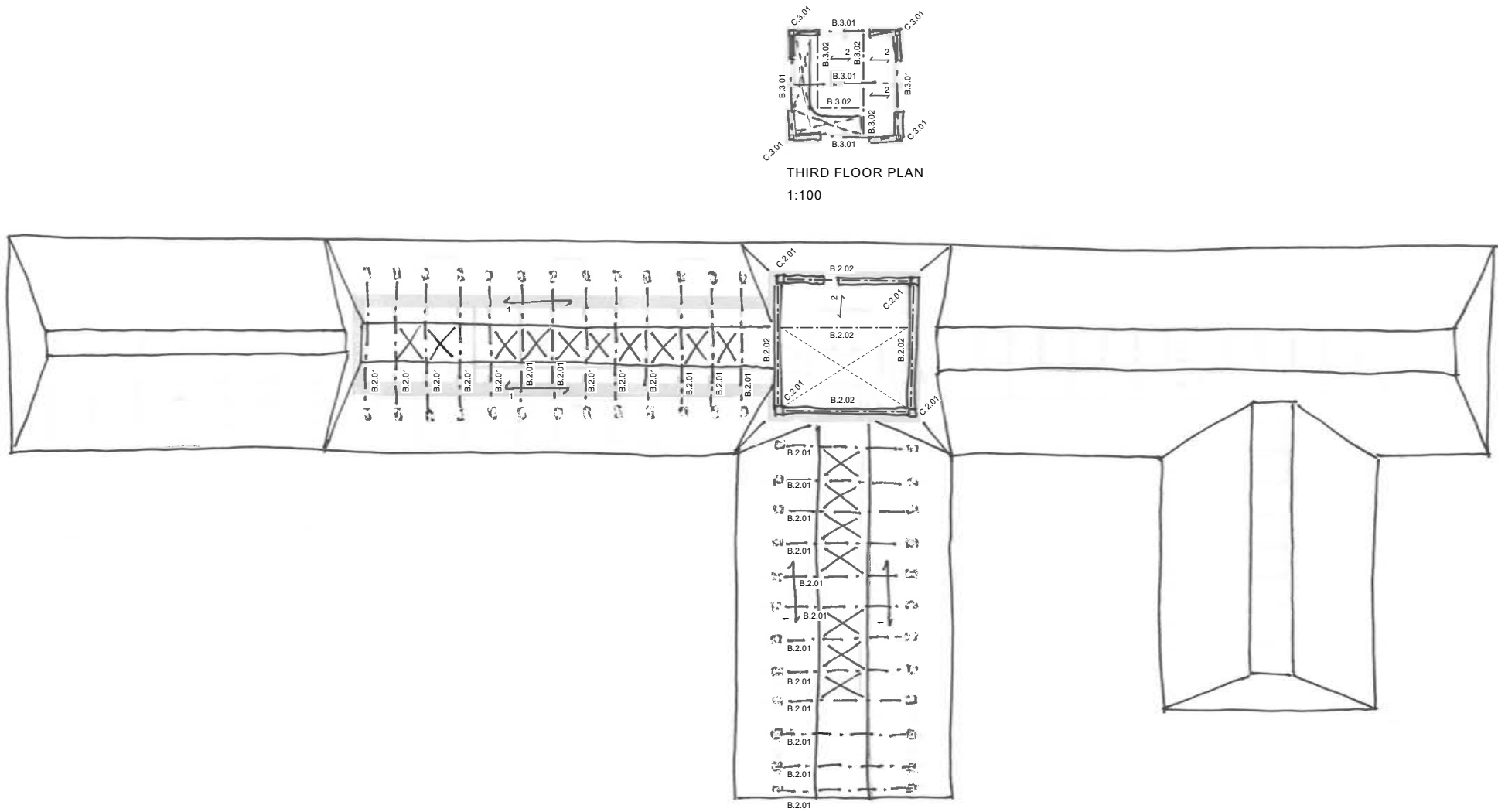
PROJECT
BREACH HOUSE

DRAWING TITLE
FIRST FLOOR PLAN

DRAWING STATUS	DRAWN	APPROVED	SCALE AT A1
PRELIMINARY	SF		NOTED

DRAWING NUMBER	REV.
22054.203	P1





SECOND FLOOR PLAN
1:100

THIRD FLOOR PLAN
1:100

ROOF PLAN
1:100

NOTES

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All dimensions in mm. Do not scale from this drawing. Setting out to Architect's details. Drawings to be printed in colour.

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KEY

- Lintels (UNO triple 44 x 145 C24 timber)
- Beam Arrangement
- 39mm Kerto LVL Q-panel
- 57mm Kerto LVL Q-panel
- 75mm Kerto LVL Q-panel
- 175thk RC slab cast over well compacted hardcore

COLUMN SCHEDULE

REF.	MEMBER SIZE	MATERIAL/GRADE/NOTES
C.0.01	Double 50 x 100	Timber C24
C.0.02	50 x 200	Timber C24
C.0.03	Double 50 x 200	Timber C24
C.1.01	50 x 200	Timber C24
C.1.02	Double 50 x 200	Timber C24
C.2.01	Double 50 x 200	Timber C24
C.3.01	Double 50 x 200	Timber C24

LINTEL SCHEDULE

REF.	MEMBER SIZE	MATERIAL/GRADE/NOTES
L.0.01	Double 75 x 360	LVL
L.0.02	Double 75 x 300	LVL

BEAM SCHEDULE

REF.	MEMBER SIZE	MATERIAL/GRADE/NOTES
B.1.01	Double 75 x 225	Timber C24
B.1.02	Double 75 x 360	LVL
B.1.03	75 x 200	Timber C24 cranked to roof profile
B.1.04	50 x 200	Timber C24
B.1.05	75 x 100	Timber C24
B.2.01	75 x 200	Timber C24 cranked to roof profile
B.2.02	Triple 75 x 225	Timber C24
B.3.01	Triple 75 x 225	Timber C24
B.3.02	75 x 225	Timber C24
B.4.01	75 x 225	Timber C24

P1	First Issue	03.03.2023
REV.	DESCRIPTION	DATE

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LONDON, SE17 3QA

PROJECT
BREACH HOUSE

DRAWING TITLE
SECOND, THIRD AND ROOF PLAN

DRAWING STATUS	DRAWN	APPROVED	SCALE AT A1
PRELIMINARY	SF		NOTED

DRAWING NUMBER	REV.
22054.204	P1



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