



Rewarding Learning

General Certificate of Secondary Education
2023

Centre Number

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Candidate Number

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Construction and the Built Environment

Unit 2
Sustainable Construction



GCN21

[GCN21]

THURSDAY 15 JUNE, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

Answer **all nine** questions.

Questions **1, 2, 3, 5** and **9** should be answered in relation to the previously issued pre-release material.

You should **not** bring any of the material previously issued into this examination.

You will be provided with a clean copy of the pre-release material.

INFORMATION FOR CANDIDATES

The total mark for this paper is 120.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in questions **7** and **9**.

A scale ruler is required.

A calculator is required.

For Examiner's use only

| Question Number | Marks |
|-----------------|-------|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |

| | |
|-------------|--|
| Total Marks | |
|-------------|--|

Questions 1, 2, 3, 5 and 9 relate to the pre-release material

1 (a) List below the material used to make each of the following elements of the dwelling shown in the pre-release material.

- 1. Chimney Copings _____ [1]
- 2. Windows _____ [1]
- 3. Flashing around the Chimney _____ [1]

(b) List below **seven** performance requirements of the external front door used in the house shown in the pre-release material.

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____
- 7. _____ [7]

(c) Where would you find a timber architrave and what would it be used for?

_____ [2]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

- 2 (a) Using the attached pre-release material give the following internal room dimensions in **millimetres**.

Some dimensions may need to be scaled.

- (i) The length and width of the **kitchen** area.

Length _____ mm Width _____ mm [2]

- (ii) The **overall width of the dwelling** at first floor level.

Width _____ mm [2]

- (iii) The length and width of the **master bedroom**.

Length _____ mm Width _____ mm [4]

- (b) Calculate the total floor area of bedroom 3. Show your calculations below.

_____ square metres [3]

- (c) (i) What is the width of the **narrowest window** on the ground floor?

_____ mm [1]

- (ii) How many individual **internal** doors would be required for this house? Count a double door as two doors.

_____ [1]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

3 (a) List **four** important properties of the **pitched roof** used for the house shown in the pre-release material.

1. _____

2. _____

3. _____

4. _____

[4]

(b) Describe how loads are **transferred from the roof and first floor** of the two-storey dwelling shown in the pre-release material. What provides the final support for these loads on top of the subsoil?

_____ [3]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

(c) Define the following construction terms.

1. Dead Loads

_____ [1]

2. Imposed Loads

_____ [1]

3. Steel Purlin

_____ [1]

4. Roof Covering

_____ [1]

5. Dormer Window

_____ [1]

6. Ridge Board

_____ [1]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

(d) Label the Eaves Detail as shown in Fig. 1. You do not require all these labels.

Timber battens on roofing felt

Continuous rafter ventilator

Plastic gutter

Eaves ventilator

Mineral wool insulation laid between joists

Rafters spaced at 400 mm centres

Cavity insulation

Wall tie

Wallplate

Plastic fascia

Soffit

Chimney pot

Ceiling joist

Ridge board

[12]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

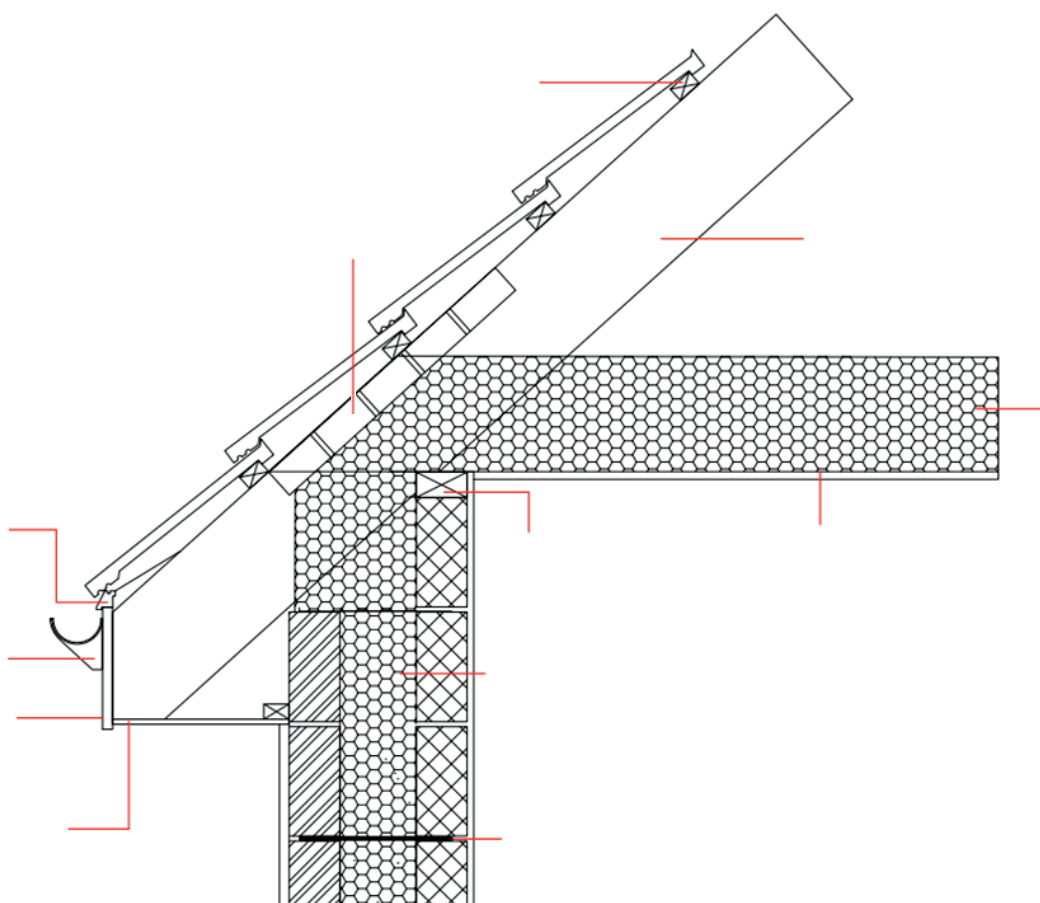


Fig. 1

Source: CCEA

5 **Fig. 2** shows an incomplete steel lintel detail which is to be used for the house shown in the pre-release material.

(a) Complete the drawing in **Fig. 2** adding the following details:

1. Outer skin of blockwork
2. External wet dash plaster
3. Steel Lintel
4. D.P.C.
5. Inner skin of blockwork
6. Window frame
7. Triple glazing
8. Gypsum plaster

[8]

You should also draw in hatch patterns to represent the following:

- | | |
|-----------------------------------|----------------------------|
| 1. Insulation in the steel lintel | 3. Outer skin of blockwork |
| 2. Inner skin of blockwork | 4. Cavity insulation |

[4]

(b) Add the labels from the list below once you have completed your drawing.

1. 100 mm blockwork outer leaf
2. Wet dash on a sand/cement render
3. Lintel
4. D.P.C.
5. 100 mm inner skin of blockwork
6. Cavity insulation
7. Window frame
8. Triple glazing PVCu window
9. Gypsum plaster
10. Air gap sealed with flexible sealant.

[10]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

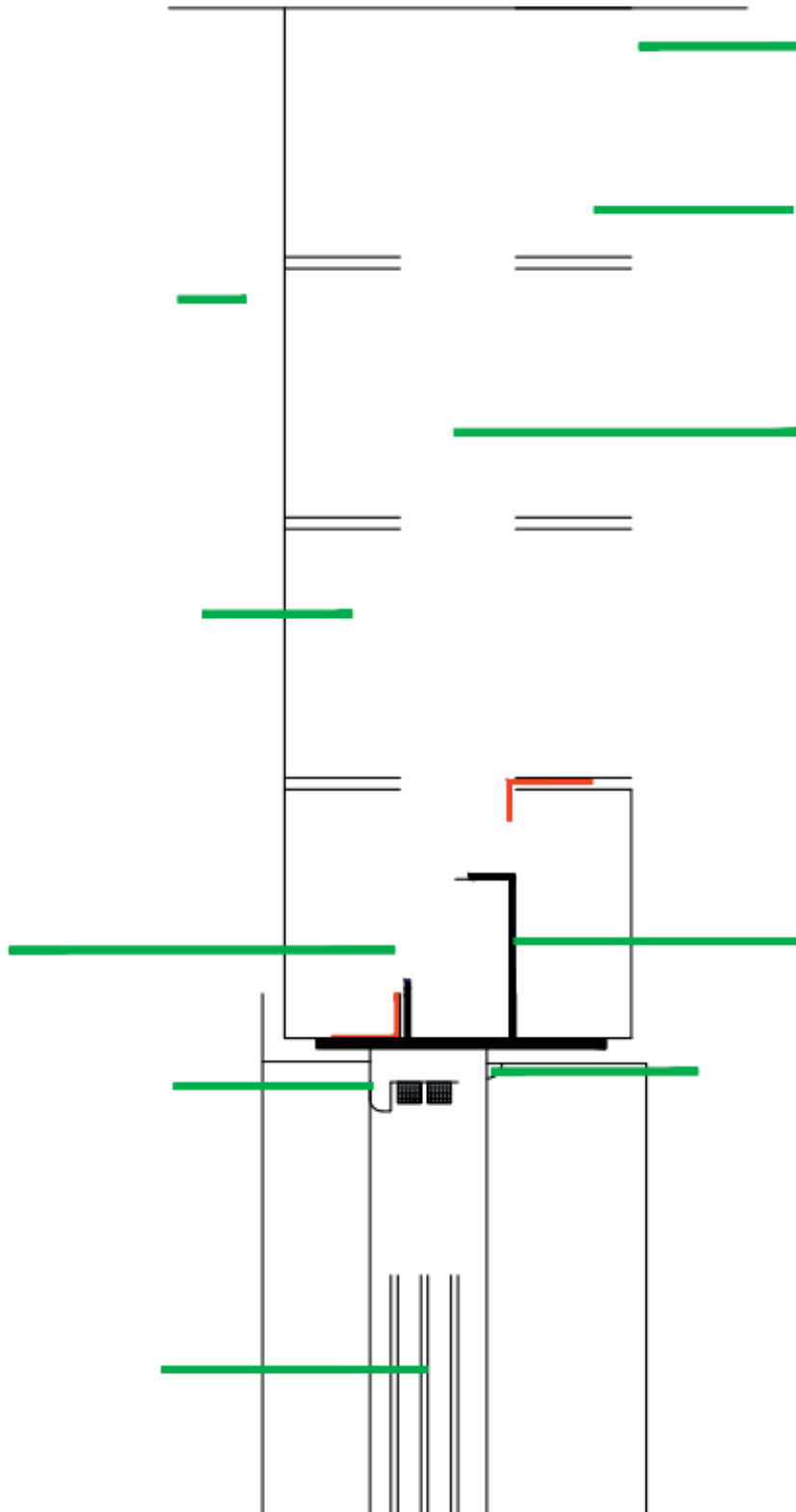


Fig. 2

Source: CCEA

6 (a) Discuss why an architect would specify **double glazed** windows for a typical domestic house.

[2]

(b) Describe clearly what you understand by a **Transom** and a **Mullion** when used in a window frame.

[2]

(c) List below **six** performance requirements of hardwood double glazed window.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

[6]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

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(Questions continue overleaf)

[10]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

8 Since April 2015 the responsibility for planning in Northern Ireland has moved mainly to the local Councils.

(a) Discuss one reason why it is necessary to apply for **Planning Permission** when developing a new housing development of five houses on a brown field site in a medium sized village.

[2]

(b) Demonstrate your understanding of the term **Green Belt** and why it is necessary to have such a planning policy.

[2]

(c) Demonstrate your understanding of why the Planning Department designated **Conservation Areas** in Northern Ireland.

[2]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

(d) Evaluate the importance of **Design, Scale and Massing** when related to an extension of a listed building formally used as a bank. The client wishes to create a new four storey extension to the existing two storey bank which will be turned into a small hotel. It is proposed to increase the overall footprint of the building by 400%. The existing bank building has vertical sliding sash windows which will be replicated in the new extension.

[4]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

- 9 The location of the house shown in the pre-release material is to be constructed on site 2 of your Site Plan.

Analyse the Site Plan provided in the pre-release material and advise the client on the type of foundation you would propose using. Information on soil conditions is available on the Site Plan.

Justify your reason for making your choice of foundation type.

Justify why you would advise the client not to build on top of the 600 mm diameter storm drain.

Quality of written communication will be assessed in your answer.

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

[10]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

THIS IS THE END OF THE QUESTION PAPER

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Construction and the Built Environment

Unit 2

Sustainable Construction

[GCN21]

THURSDAY 15 JUNE, MORNING



GCN21

INFORMATION FOR CANDIDATES

A copy of the pre-release information for this examination is included in the following pages.

You must use this clean copy of the Pre-release Material in the examination and not your own annotated copy.

**PRE-RELEASE
MATERIAL**

Scenario

A client has purchased a green field site in a semi-urban area. The site is in an area of two storey detached dwellings. The client has appointed an architect and has stated a design brief as follows:

- Two storey detached house
- Floor Area – 200 to 300 m²
- Accommodation – 3 or 4 bedrooms with 1 en-suite, kitchen, toilet/bathroom facilities, living room or rooms and a dining area.
- Double garage either attached or detached could be included but is not a necessity.
- The design must include at least one renewable energy source.
- The budget is £400,000

The local planning authorities have indicated the proposals must complement the surrounding area with a maximum ridge height of 8.0 m adhered to, match existing adjacent properties. Three sites have been identified as possible locations. A site investigation indicates:

Site 1

The soil is of typical boulder clay of good bearing capacity at a typical depth of 400 mm. Ground water does not appear to create any problems and no unduly high levels of sulphates were found.

Site 2

The site has an elevated platform which is filled ground. On investigation, the platform has been made up of spoil. The spoil is made up of a mixture of topsoil, builder's rubble and excavated subsoil to a maximum depth of 3000 mm. Soil of a firm bearing capacity similar to site one was found below this depth.

Site 3

This site is adjacent to a river and as such is liable to flooding. Records produced by The Environmental Heritage Service show a maximum river water rise of 200 mm above the riverbank at this location in the past 5 years.

The soil is of a silty nature to a depth of approximately 900 mm with a gravel bed of approximately 200 mm thick below. The gravel bed sits on a layer of clay approximately 500 mm thick. A good bearing stratum was found at a depth of 1800 mm.

The average water table level fluctuates between 200 mm and 400 mm below ground level, rising when flooding occurs.

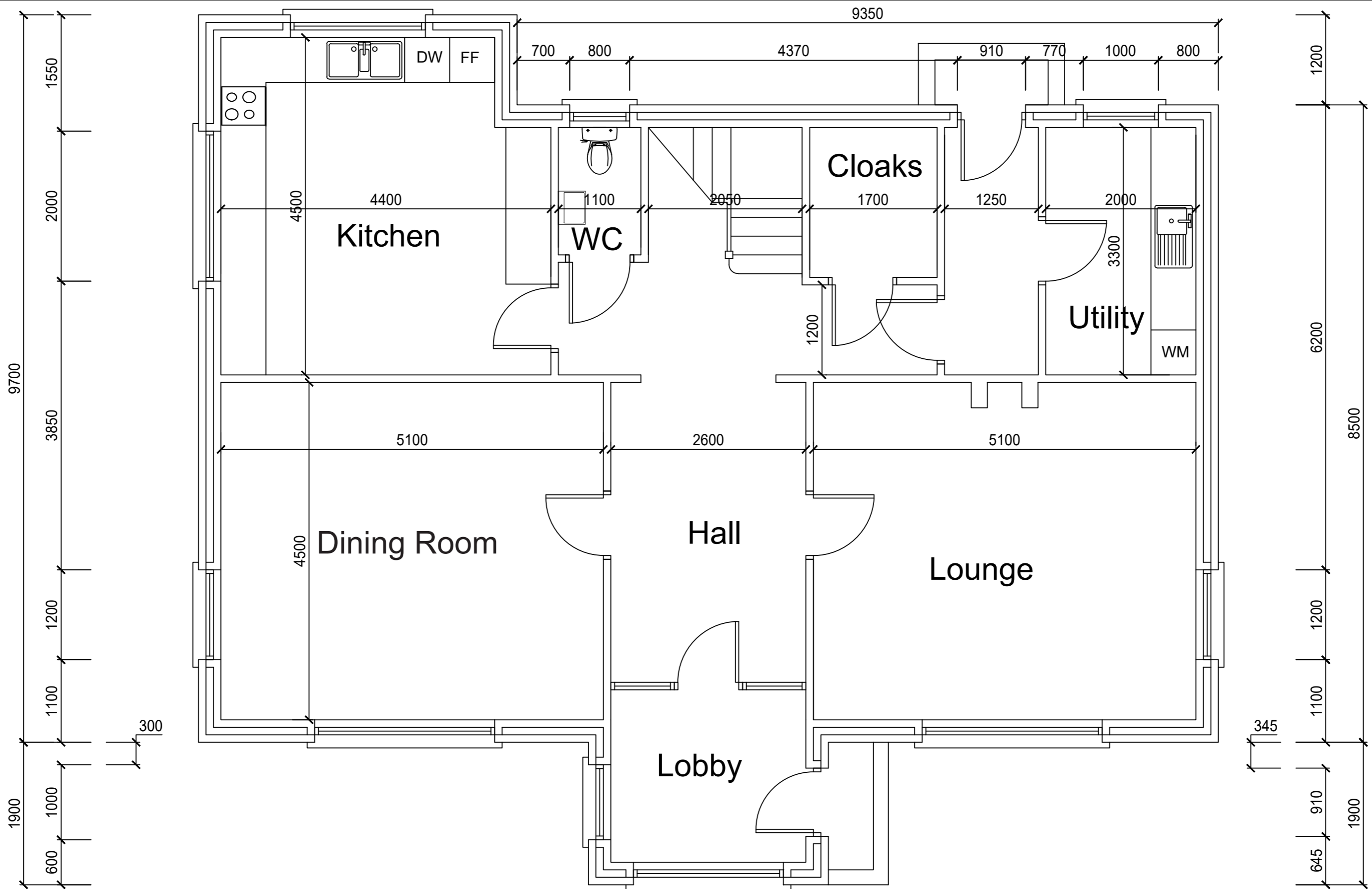
The design team have produced the drawings, which will be sufficient to satisfy the requirements of the local planning and building control authorities.

Specification notes for construction:

- **Walls:** Cavity wall construction comprising; 100 mm outer clay facing brickwork skin, 100 mm cavity with insulation board, 100 mm inner concrete blockwork skin with plastered finish.
- **Roof:** 37 degree pitched trussed roof comprising; 200 mm × 38 mm trusses spaced at 400 mm centres, 200 mm × 38 mm ceiling joists spaced at 400 mm centres supported on 100 mm × 50 mm timber wall plate. Concrete roof tiles.
- **Floor Construction:** Solid concrete floor comprising; 100 mm concrete slab, 125 mm Kingspan floor insulation, 25 mm to perimeter of slab, 1200-gauge damp proof membrane, 100 mm subfloor concrete on 20 mm blinding with 150 mm crusher run hardcore below.
- **First floor Construction:** Timber floor joist with T&G floorboards and plasterboard ceiling to underside.
- **Renewables:** Ground source heat pump to provide hot water for underfloor ground floor heating system.
- **Windows and doors:** Triple glazed uPVC Plastic.
- **Chimneys.** Clay facing brick with precast concrete chimney copings. Lead flashings around chimneys.
- **Damp proof course:** Vertical D.P.C.'s to all window and external door jambs, horizontal D.P.C. behind and under sills and stepped lintels. Wall D.P.C.'s to external skin, layers at 150 mm minimum above finished ground levels. D.P.C.'s to internal walls to overlap and be bonded to floor D.P.M. by a minimum of 215 mm.

NOTE Students will require the use of a scale ruler during the examination.

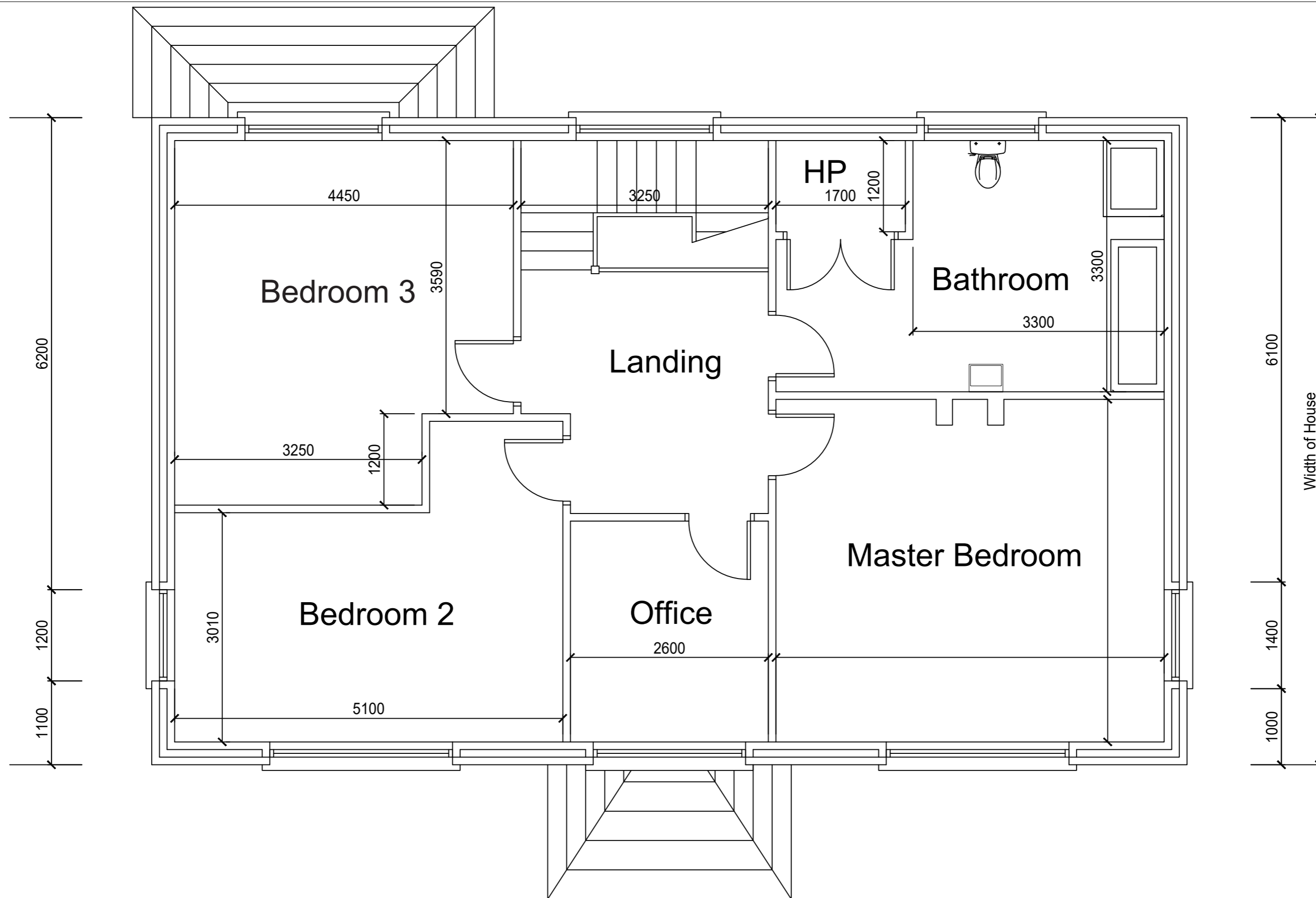
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**GCSE Construction
&
The Built Environment**

SPECIFICATION DETAILS:
Unit: Unit 2
 Pre-Release Materials

DRAWING DETAILS:
Dwg No: 01
Title: Ground Floor Plan
Scale: 1:50
Date: Summer 2023



**GCSE Construction
&
The Built Environment**

SPECIFICATION DETAILS:

Unit: Unit 2
Pre-Release Materials

DRAWING DETAILS:

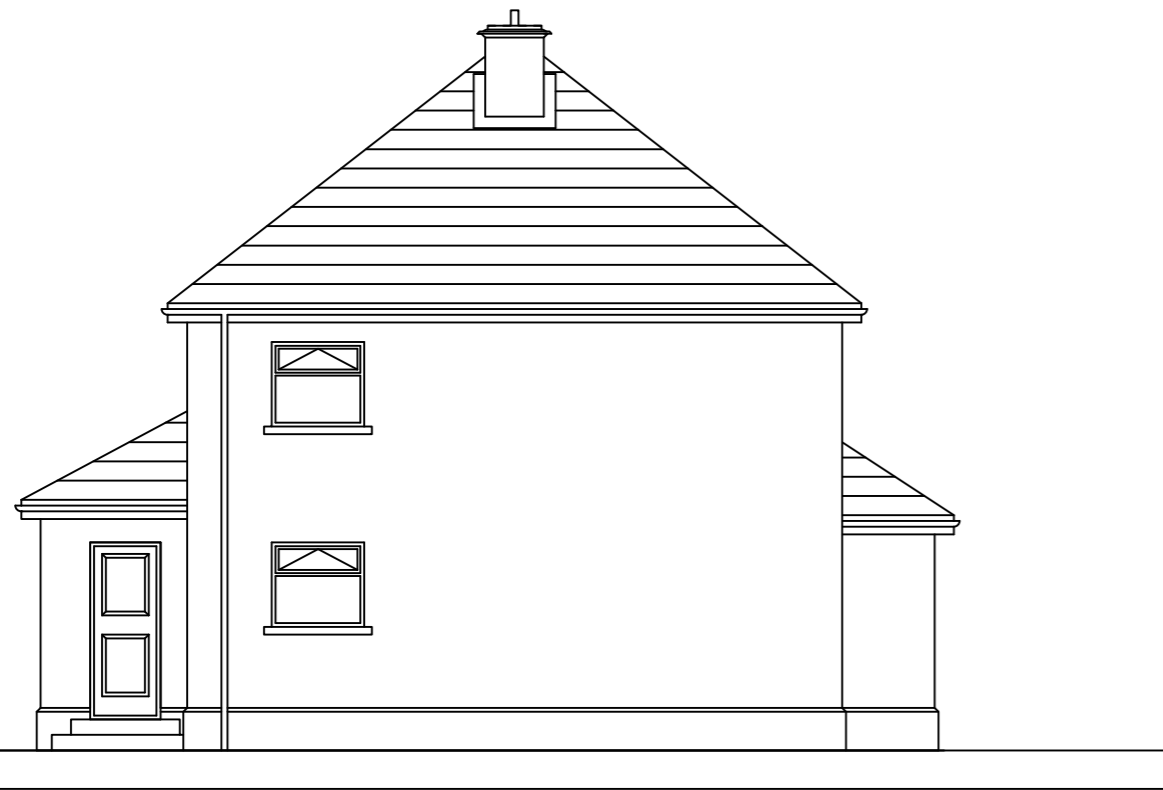
Dwg No: 02
Title: First Floor Plan
Scale: 1:50
Date: Summer 2023



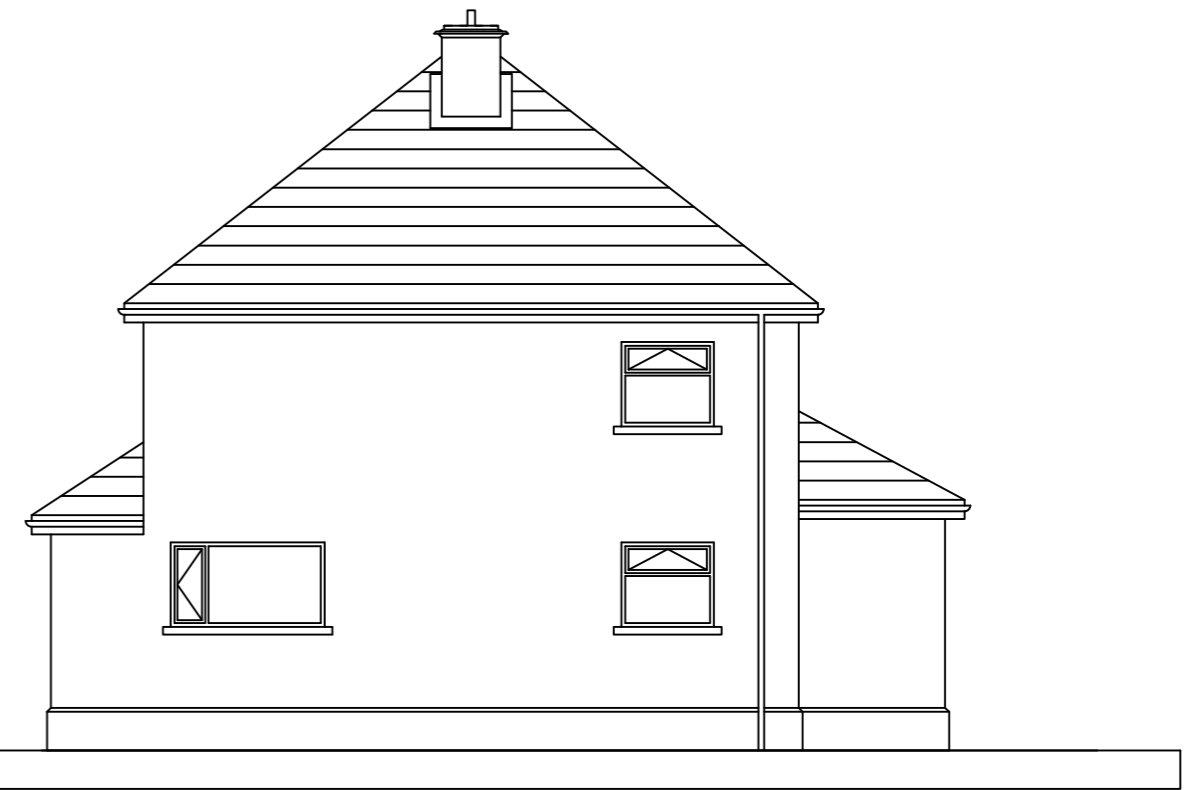
Front Elevation



Rear Elevation



Side Elevation



Side Elevation

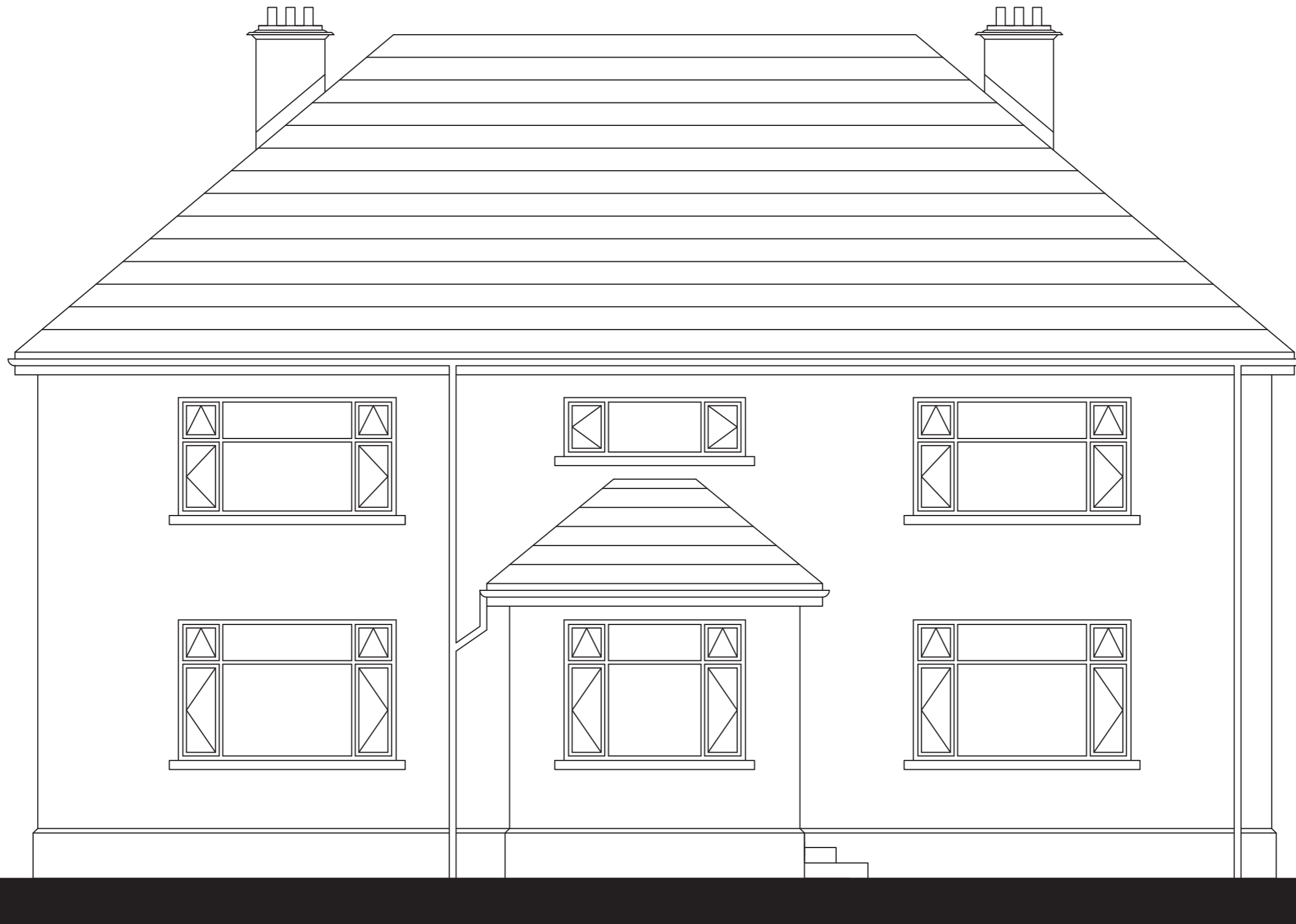
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SPECIFICATION DETAILS:

Unit: Unit 2
Pre-Release Materials

DRAWING DETAILS:

Dwg No: 03
Title: Elevations
Scale: 1:100
Date: Summer 2023



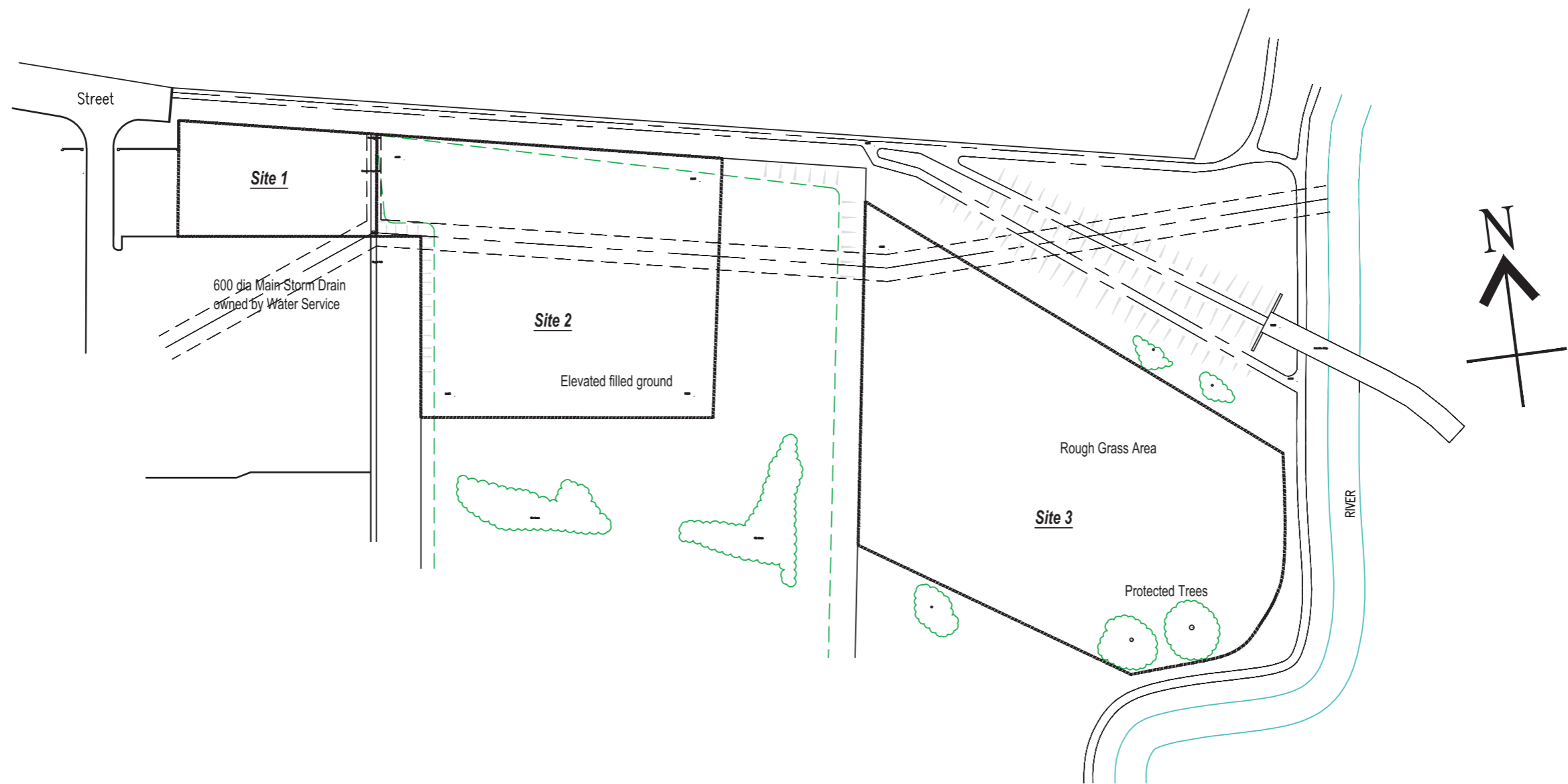
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SPECIFICATION DETAILS:

Unit: Unit 2
Pre-Release Materials

DRAWING DETAILS:

Dwg No: 04
Title: Front Elevation
Scale: 1:50
Date: Summer 2023



**GCSE Construction
&
The Built Environment**

SPECIFICATION DETAILS:

Unit: Unit 2
Pre-Release Materials

DRAWING DETAILS:

Dwg No: 05
Title: Site Plan Options
Scale: Not to Scale
Date: Summer 2023

