



Gas Protection Design & Verification Plan

128 Barrier Bank, Cowbit,
Spalding, PE12 6AL

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EXECUTIVE SUMMARY

MEC Environmental Ltd (MEC) has been appointed by Scenic Homes Limited ('The Client') to provide a Design Report and Verification Plan for ground gas mitigation requirements associated with the proposed residential development at 128 Barrier Bank, Cowbit, Spalding, PE12 6AL (hereafter referred to as 'The Site').

This report:

- Assesses the ground gas risk – **Sections 2, 3 and 4;**
- Determines the scope of required mitigation necessary to manage the associated gas risk – **Sections 5 and 6;**
- Sets out the remit of required verification for the gas mitigation – **Section 7; &**
- Highlights construction phase management controls relating to ground gas – **Section 8.**

With respect to gas risk, this document supersedes all previous documents.

It is incumbent on The Client to review the content of this report and ensure that MEC's interpretation of the construction proposals is accurate (see Section 1.3). Any changes to the construction proposals outlined should be notified to MEC for review (and update of this report if / as required).

This document should be read in its entirety, but of note:

- **Section 5:** Gas risk mitigation is required to both the houses and garage structures, comprising sub-slab venting (see Section 5.2 for houses and Section 5.3 for garages) plus provision of a gas resistant membrane (see Section 5.4 – houses and garages)
- **Section 8.1:** Following successful verification of the gas resistant membrane, protection (insulation board to houses, screed to garages) should be placed promptly to prevent damage by follow-on trades.
- **Section 8.2:** All service ducts which pass through the floor slab construction should be sealed.
- **Section 8.3:** Fixings through the gas resistant membrane should be avoided or subject to design and adoption of a suitable gasket detail (MEC to be consulted).

It is the responsibility of The Client (or their appointed Planning Consultant) to submit a copy of this document for approval to the Local Authority (as/if required per Planning Conditions) and any development Warranty Provider. MEC do not make these submissions direct, but will provide technical support as/if required following submission. **It is strongly recommended that the contents of this report are not acted on until approval has been granted.**

1 Introduction

1.1 Report Objectives

MEC Environmental Ltd (MEC) has been appointed by Scenic Homes Limited ('The Client') to provide a Design Report and Verification Plan for ground gas mitigation requirements associated with the proposed residential development at 128 Barrier Bank, Cowbit, Spalding, PE12 6AL (hereafter referred to as 'The Site').

This report:

- Assesses the ground gas risk – **Sections 2, 3 and 4;**
- Determines the scope of required mitigation necessary to manage the associated gas risk – **Sections 5 and 6;**
- Sets out the remit of required verification for the gas mitigation – **Section 7; &**
- Highlights construction phase management controls relating to ground gas – **Section 8.**

With respect to gas risk, this document supersedes all previous documents.

This report has been prepared in general accordance with UK Guidance and good practice, including (but not limited to):

- NF94 – Hazardous Ground Gases, An Essential Guide for Housebuilders (NHBC, 2023)¹.
- BS8485:2015+A1:2019 – Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings (BSI, 2019).
- CIRIA Report C735 – Good Practice on the Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases (CIRIA, 2014).

The above documents require demonstration of competence; specifically, that person(s) undertaking such reports have appropriate knowledge, skill, experience and qualification(s). This report has been prepared by a Chartered Geologist with over 20yrs experience in professional practice who is a specialist ground gas risk assessor, being Accredited by the Society of Brownfield Risk Assessment (ASoBRA²) for both Permanent Gases and Vapour Intrusion.

¹ NF94 was prepared for use on residential buildings providing a framework for the investigation, assessment, design, construction and operation of ground gas risks / mitigation systems. This document is free to download via the following link:
<https://www.nhbc.co.uk/foundation/hazardous-ground-gas>

² <https://sobra.org.uk/accreditation/register-of-sobra-risk-assessors/>

1.2 Information

This report is based on information provided to MEC by The Client – see Table 1.

Table 1. Information Provided to MEC to Inform Gas Protection Design

Author	Date	Reference	Title
Elemental GI Limited	June 2022	E22131/1/0	Phase 1 Geo-Environmental Assessment for Site Off Barrier Bank, Cowbit, Spalding.
	July 2024	E22131/2/1	Phase 2 Geo-Environmental Investigation for site Off Barrier Bank, Cowbit, Spalding.
Note: It is not the purpose of this report to reiterate the full content of the above documents. However, where required to inform the gas risk / design process, pertinent information is summarised. The above documents are normative references to this report and should be read in conjunction with it. Should the reader require full copies of the documents a written request should be provided to Scenic Homes Limited.			

1.3 Proposed Development

The development comprises 5 No. residential houses referred to as Plots 1 to 5. Development Plots 1, 3 and 5 have detached garages. A development layout drawing is provided as Figure 1.



Figure 1. Proposed Site Plan (Seven 22 Architecture Limited, Drawing Number 089-SP-01, Rev A, June 2024)

In addition to the documents listed in Table 1, a selection of drawings has been provided for the residential dwellings which show the proposed foundation and floor slab construction. A copy of these drawings is provided in Appendix A. In summary:

- **Foundations:** Case driven piles, terminated at circa 10m to 12m below ground level, grouted with concrete slurry and terminated to reinforced concrete ground beams;
- **Floor Slab Construction:** The floor slab construction (bottom up) comprises:
 - **Passive Sub-Slab Venting:** Minimum 200mm deep open void, passively vented via a series of telescopic (cranked) vents to air bricks located on two opposing elevations of each dwelling, with cross-venting provision to sleeper walls*.
 - **Beam and Block Floor Slab.**
 - **Insulation (150mm thk).**
 - **Screed (75mm thk).**
 - **Finishes.**

**Note: Ventilation Markups have been provided for Plots 1 to 5 inclusive, showing the location of proposed telescopic air bricks and cross-venting to sleeper walls. The provisions exceed the requirements of England Building Regulations Approved Document Part C. Copies of these drawings are presented in Appendix B.*

- **Detached Garages (Plots 1, 3 & 5):** As per the residential dwellings, the detached garages will be constructed on case driven piled foundations, with a block and beam floor slab and vented sub-floor void. The only difference with the garage structure(s) is that insulation will not be included within the floor slab construction makeup, with screed placed over the block and beam floor slab.

2 Preliminary Risk Assessment

2.1 Site Location and Description

The site is located at 128 Barrier Bank, Cowbit, Spalding, PE12 6AL. The site comprises an area of approximately 0.26 Hectares and is located at National Grid Reference 526062, 317893.

The site is understood to have comprised a former small holding, which included various structures including a workshop, shed, 2 No. barns, a kennel and a 'U' shaped structure (that may have been used to contain areas of burning (i.e. bonfires)).

The Phase 1 (Elemental, 2022) included a walkover description of the site prior to clearance for development and noted the presence of mounds of building rubble / mixed soils, small-scale storage of fuels, paints and cleaning fluids, a former concrete base (which possibly related to an Above [ground fuel] Storage Tank (AST)) and the local presence of asbestos sheeting.

When Elemental returned to site to complete the Phase 2 works (July 2024) former structures had been demolished and the site cleared to facilitate redevelopment. Levels on the far-eastern portion of the site were reported to have been locally raised.

2.2 Surrounding Area Description

The site is located in a rural area, with land uses immediately adjacent comprises a Village Hall, Church, residential properties, public open space and Barrier Bank with agricultural land beyond.

2.3 History

Per Section 2.1, the site comprises a former small holding dating back to the 1800's, associated with which various structures have been constructed over the years including barns, animal coops, green houses, sheds and workshops etc. Made Ground should be anticipated across the site associated with the construction, alteration and demolition of these various structures.

The surrounding area comprises predominantly agricultural land which (to the north, east and south) has been subject to development for housing and/or community provision (Chapel, School etc.).

Historical maps indicate marshy ground extensively to the west of the site (and more generally in the surrounding area), associated with low-lying fen farmland and former flood plain of the River Welland. Barrier Bank and various Drains / Channels have been constructed to manage water across the area.

2.4 Geology

The geology of the area comprises Tidal Flat Deposits (mud flat / sand flat deposits, including Peat) underlain by the Oxford Clay Formation (Mudstone).

2.5 Hydrology & Hydrogeology

The drift and solid geology both comprise Unproductive Strata, i.e. low permeability materials which will have negligible significance for water supply or river base flow.

Associated with the low-lying fenland, various Drains and Channels are present near the site, with the South Holland Main Drain indicated to be culverted below the site.

Comment on flood risk is beyond the scope of this document.

2.6 Radon

The site is located in an area where the estimated probability of radon exceeding the specified Action Level (200Bq/m³) is <1%. Radon mitigation is not required within new buildings or extensions.

2.7 Surface Ground & Mineral Workings

No areas of surface ground or mineral working are listed within 250m of the site.

2.8 Coal Mining

The site is not located in an area of coal mining.

2.9 Landfills

No landfills are listed within 250m of the site.

2.10 Summary of Preliminary Risk Assessment (PRA) Findings

In summary, the PRA has not identified any sources of off-site ground gas (e.g. landfills, infilled workings, mine workings, radon etc.) which would pose a credible risk at the site. The potential sources of ground gas identified by the PRA on-site are associated with organic material within the natural geology of the Tidal Flat Deposits (which is prevailing across the area) and any Made Ground which results from historical on-site phases of development and demolition.

3 Site Investigation & Monitoring

3.1 Intrusive Works

Intrusive works completed on site by Elemental GI Limited (July 2024) comprised 7 No. window sampler boreholes extended to between 3m and 4m below ground level in combination with soil phase chemical testing. Gas/groundwater monitoring standpipes were installed at 3 No. locations (WS02, WS03 and WS06), with 6 No. return gas/groundwater monitoring events subsequently completed. An exploratory hole location plan is presented as Figure 2.

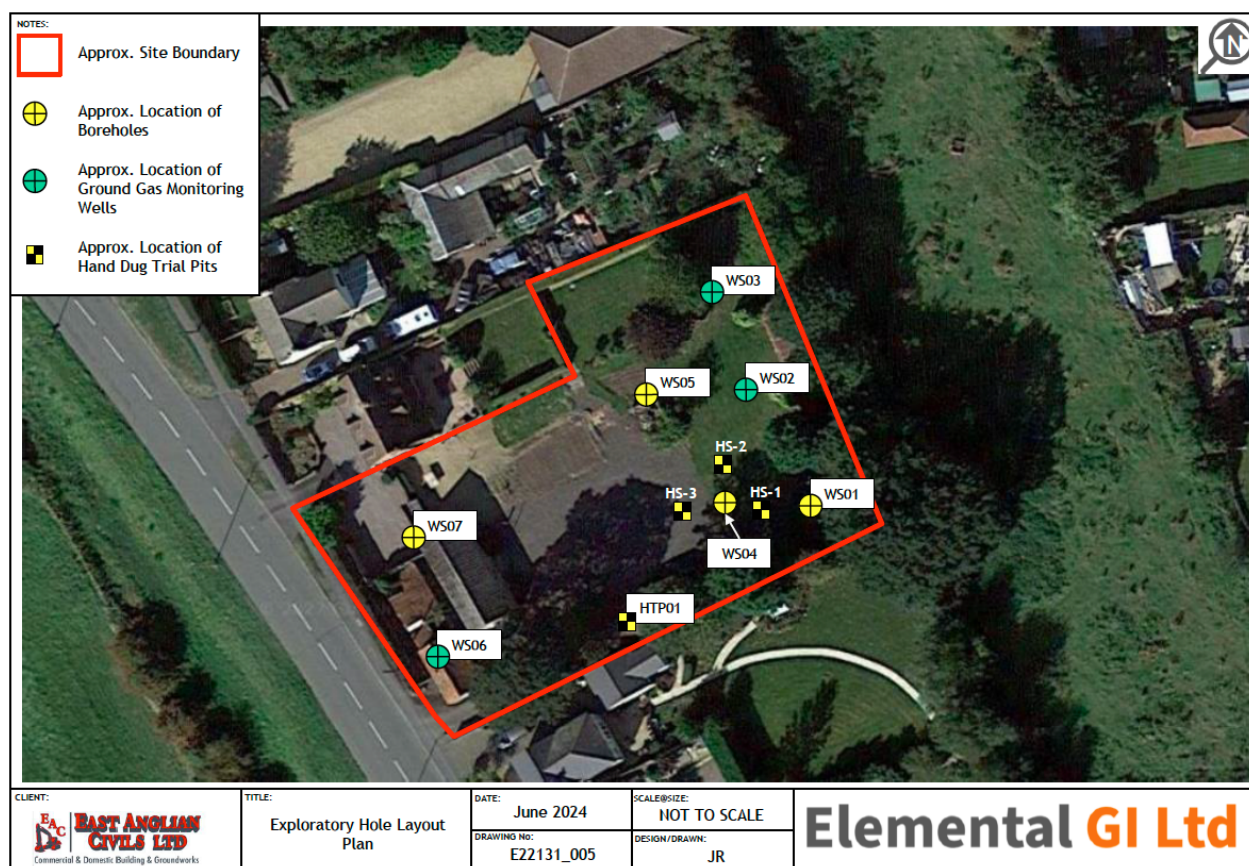


Figure 2. Exploratory Hole Location Plan – Extracted from Elemental GI Ltd Phase 2, July 2024

The exploratory holes completed by Elemental are considered to provide reasonable coverage of the site following demolition and clearance activities, whilst acknowledging that site access was constrained by the embargo zone associated with the South Holland Main Drain and commencement of on-site construction works. Of note, WS01, WS02 & WS03 were located on the eastern portion of the site (in the area of inferred locally raised site level), WS05 was located in the proximity of the former 'U' shaped structure (where burning was previously indicated) and WS07 was located near the suspected position of the former AST.

3.2 Ground Conditions

Encountered ground conditions were consistent with the known history and geology of the site, see Table 2.

Table 2. Encountered Ground Conditions

Exploratory Hole ID	Thickness of Made Ground and Anthropogenic Content	Tidal Flat Deposit Composition	Standpipe Response Zone (RZ) Details
WS01	GL to 0.7m Sandy silt with brick, clinker, concrete and insulation foam.	0.7m+ Sandy SILT with decayed organic matter from 2.3m depth.	-
WS02	GL to 1.9m Sandy silt with clinker and brick. Below 1.55m with rootlets and decayed organic matter.	1.9m+ Sandy SILT with abundant organic matter.	RZ: 1.0m to 3.0m Targets Made Ground and Tidal Flat Deposits.
WS03	GL to 1.25m Gravelly silt with clinker and brick.	1.25m+ Sandy SILT with Peat 1.65m to 1.82m and decayed organic matter at depth.	RZ: 1.0m to 4.0m Targets Made Ground and Tidal Flat Deposits.
WS04	GL to 0.45m Silty sandy gravel of clinker, brick and concrete.	0.45m+ Silty sand with Peat 1.95m to 2.0m and decayed organic matter / decayed rootlets below 2.0m.	-
WS05	GL to 0.65m Sandy silt with unspecified gravel content.	0.65m+ Silty sand with Peat 1.65m to 1.68m and decayed organic matter at depth.	-
WS06	GL to 1.5m Silty gravelly sand with brick and clinker.	1.50m+ Silty SAND / sandy SILT with decayed organic matter, roots / rootlets and Peat 2.6m to 2.7m and 3.75m to 3.9m.	RZ: 1.0m to 4.0m Targets Made Ground and Tidal Flat Deposits.
WS07	GL to 0.45m Silty sandy gravel of clinker, brick and concrete.	0.45m+ Silty SAND with decayed organic matter at depth and Peat 2.75m to 3.0m.	-

In summary, Made Ground was encountered to a maximum depth of 1.9m bgl (average 1m thickness) predominately comprising sandy silt with inclusions of brick, clinker, and concrete. Per The Local Authority Guide to Ground Gas (CIEH, 2008³), Made Ground with low degradable organic content will have a 'very low' gas generation potential and pose a 'very low' risk to on-site development.

Below the Made Ground, Tidal Flat Deposits were encountered. The Tidal Flat Deposits predominantly comprised sandy silt with variable organic content including lenses / beds of Peat. Per The Local Authority Guide to Ground Gas, natural strata with a high degradable organic content (e.g. Peat) will have a 'very low to low' gas generation potential and pose a 'low' level of risk to on-site development. It is well documented that, whilst elevated methane and/or carbon dioxide may well be present within the organics / Peat, the gas is historically generated and trapped/adsorbed within the soil pores such that there is negligible current gas generation.

³ Chartered Institute of Environmental Health. The Local Authority Guide to Ground Gas. CIEH, 2008.

3.3 Groundwater Conditions

During the intrusive works, groundwater strikes were typically recorded within the Tidal Flat Deposits at between 0.92m and 1.90m bgl, see Table 3. The exception to this was WS06, where no water strike was recorded during the intrusive works.

Gas and groundwater monitoring standpipes were installed at locations WS02, WS03 and WS06 – each targeting a combination of the Made Ground and Tidal Flat Deposits.

The standpipes were each monitored on 6 No. occasions between 5 June 2024 and 10 July 2024, with relatively stable water levels recorded in WS02 and WS03.

At WS06 an increased water level was observed between the termination of borehole drilling (23 May 2024, borehole 'dry') and the first groundwater monitoring event (5 June 2024, water recorded at 1.02mbgl). During the visit 5 June 2024 it is reported that WS06 was bailed, with slow recharge observed. However, water levels had rebounded by the second monitoring visit (14 June 2024, water recorded at 1.15mbgl) and remained high for all subsequent gas monitoring events.

With respect to ground gas, response zones are generally acknowledged to be flooded (or at least partially flooded) if water levels are recorded within 0.5m of the top of the slotted response zone. This was the case for all monitoring events at WS06.

Table 3. Encountered Groundwater Conditions

Exploratory Hole ID	Groundwater Observations - Intrusive Works	Standpipe Response Zone (RZ) Details	Groundwater Level - Monitoring Events					
			5/6/24	14/6/24	21/6/24	25/6/24	1/7/24	10/7/24
WS01	Water strike at 1.54m, in Tidal Flat Deposit.	-	-	-	-	-	-	-
WS02	Water strike at 1.71m, in Tidal Flat Deposit.	RZ: 1.0m to 3.0m Targets Made Ground and Tidal Flat Deposits.	1.60	1.63	1.68	1.73	1.78	1.65
WS03	Water strike at 1.90m, in Tidal Flat Deposit.	RZ: 1.0m to 4.0m Targets Made Ground and Tidal Flat Deposits (inc. Peat).	1.78	1.88	1.90	1.91	1.95	1.93
WS04	Water strike at 1.04m, in Tidal Flat Deposit.	-	-	-	-	-	-	-
WS05	Water strike at 0.92m, in Tidal Flat Deposit.	-	-	-	-	-	-	-
WS06	No water strike recorded.	RZ: 1.0m to 4.0m Targets Made Ground and Tidal Flat Deposits (inc. Peat).	1.02 [NOTE: Bailed After Monitoring]	1.15	1.10	1.23	1.35	1.26
WS07	Water strike at 1.07m, in Tidal Flat Deposit.	-	-	-	-	-	-	-

3.4 Ground Gas Conditions

Standpipes were installed in WS02, WS03 and WS06, which targeted the exploratory hole positions that recorded slightly increased thicknesses of Made Ground (WS02/WS03) and/or the presence of Peat within the Tidal Flat Deposits (WS03/WS04). Per Sections 2.10 and 3.2, these response zones are considered to target the main credible sources of ground gas below the site.

The standpipes were monitored on 6 No. occasions – see Table 4.

Table 4. Summary of Gas Monitoring Events

Visit Number	Date	Atmospheric Pressure (mb)
1	5 June 2024	1013 / 1014
2	14 June 2024	999 / 1001
3	21 June 2024	1014
4	25 June 2024	1015 / 1016
5	1 July 2024	1016
6	10 July 2024	1009

In total, the gas monitoring events spanned a period of approximately 6 weeks and included a range of temporal conditions, including 1 No. low pressure event (circa 1000mb). Given the ‘very low to low’ gas generation potential of the identified credible ground gas sources (i.e. Made Ground with low degradable organic content and Tidal Flat Deposits with organics / Peat) this regime of gas monitoring is considered sufficient. Certainly, it is unlikely that additional monitoring and/or monitoring over an increased barometric pressure range would have significantly altered the recorded gas regime. This is because, in these ground conditions, the main mechanism for any gas migration is via diffusion through the soil pores, which is a very slow process due to the lack of on-going (pressure driven) gas generation – further impeded by the fine-grained, shallow and saturated nature of the soil pores. In these ground conditions, barometric pressure changes will have minimal effect on ground gas conditions.

Per the discussion in Section 3.3, the response zone associated with WS06 was flooded (or at least partially flooded, with less than 0.5m (0.02m to 0.35m) of unsaturated response zone) throughout all monitoring events. Whilst groundwater levels in WS06 are a result of the prevailing ground conditions and could not reasonably have been avoided, the resultant data quality issues associated with the monitoring information collected from WS06 should be recognised. Certainly, UK Guidance is clear that gas monitoring data obtained from flooded response zones is unlikely to be representative of the gas regime in the unsaturated zone and should not be used to assess gas risk at a site. Indeed, the NHBC’s NF94 Publication is clear that gas monitoring data from flooded wells can give an unreliable indicator of elevated gas risk where none is actually present, citing incorrect gas risk designations at various sites – notably those underlain by Alluvium and Peat. Ultimately, the gas generation potential of such material is well established and thus, whilst gas monitoring data is a useful tool for site assessment, it should be considered as one line of evidence within the context of the site’s ground gas model.

Noting the above, observed ground gas conditions are summarised below:

3.4.1 Flow

Table 5a. Summary of Gas Monitoring Information, Flow

Exploratory Hole ID	Response Zone Partially Flooded?	Peak Flow (l/hr)	Steady Flow (l/hr)	Peak Flow (l/hr)	Steady Flow (l/hr)	Peak Flow (l/hr)	Steady Flow (l/hr)	Peak Flow (l/hr)	Steady Flow (l/hr)	Peak Flow (l/hr)	Steady Flow (l/hr)	Peak Flow (l/hr)	Steady Flow (l/hr)
		5/6/24* Visit 1		14/6/24 Visit 2		21/6/24 Visit 3		25/6/24 Visit 4		1/7/24 Visit 5		10/7/24 Visit 6	
WS02	No	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
WS03	No	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
WS06	Yes	<0.1	<0.1	48.9	<0.1 [3.9] ¹	10.9	<0.1 ²	28.8	<0.1 ³	<0.1	<0.1	27.3	<0.1 ⁴

Notes:
* WS06 groundwater bailed after visit 5 June 2024 due to response zone being flooded.
1. Settled at <0.1l/hr after 60 seconds, with brief fluctuations to ~3.9l/hr every 10-15 seconds thereafter.
2. Settled at <0.1l/hr after 60 seconds.
3. Settled at <0.1l/hr after 20 seconds.
4. Settled at <0.1l/hr after 20 seconds.

Per Table 5a, WS02 and WS03 recorded low rates of flow, <0.1l/hr. These flow rates are consistent with the ground model and 'Low to Very Low' gas generation potential of the identified credible sources.

Consistent with WS02 and WS03, at WS06 (despite the water level rise between drilling (dry) and Visit 1 (5 June 2024)), flow rates during the first monitoring event (Visit 1) were low (<0.1l/hr).

However, at WS06, during subsequent monitoring events an elevated peak flow rate was initially recorded (maximum 48.9l/hr), reducing to a much lower steady flow within 1-minute (typically <0.1l/hr). These short-lived peak flows are not indicative of sustained flow of gas from either the Made Ground or Tidal Flat Deposits. Instead, they are associated with:

1. Disturbance of the water column following the bailing undertaken after monitoring Visit 1 (5 June 2024). The effect of this is twofold –
 - a. Water level rebound within the standpipes results in an artificial gas pressure (referred to as 'the piston effect');
 - b. The physical bailing process agitates the water column and increases sediment load (including organics) associated with the natural geology. The organic material agitated in the water column degrades to produce small values of methane and/or carbon dioxide, which is trapped within the artificial orifice created by the flooded standpipes' limited response zone. However, there is no on-going generation under pressure, such that the volume of gas quickly dissipates over the monitoring event; and
2. Even once water levels are 'stable' following the bailing, minor fluctuations of water levels within the partially flooded response zone occur. These result in pressure fluctuations within the unsaturated portion of the response zone headspace which are observed via short-term pressure releases that dissipate quickly during the monitoring event.

The above are why ground gas monitoring via restricted well headspace is not a good indicator of risk and why UK Guidance cautions against using such data.

Accepting the above, steady credible flows at this site are consistently low (typically not exceeding 0.1l/hr), which is consistent with the ground gas model.

3.4.2 Methane

Table 5b. Summary of Gas Monitoring Information, Methane (CH₄)

Exploratory Hole ID	Response Zone Partially Flooded?	Peak CH ₄ (%v/v)	Steady CH ₄ (%v/v)	Peak CH ₄ (%v/v)	Steady CH ₄ (%v/v)	Peak CH ₄ (%v/v)	Steady CH ₄ (%v/v)	Peak CH ₄ (%v/v)	Steady CH ₄ (%v/v)	Peak CH ₄ (%v/v)	Steady CH ₄ (%v/v)	Peak CH ₄ (%v/v)	Steady CH ₄ (%v/v)
		5/6/24* Visit 1		14/6/24 Visit 2		21/6/24 Visit 3		25/6/24 Visit 4		1/7/24 Visit 5		10/7/24 Visit 6	
WS02	No	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
WS03	No	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
WS06	Yes	0.8	0.4	44.0	15.6	41.9	2.2	34.5	0.5	68.4	1.1	50.3	1.2
Notes:													
* WS06 groundwater bailed after visit 5 June 2024 due to response zone being flooded.													
Steady readings are indicated to be typically recorded at 90 to 120 seconds.													

WS02 and WS03 consistently recorded low concentrations of methane, <0.1%v/v.

At WS06, despite the water level rise between drilling (borehole dry) and Visit 1 (5 June 2024), methane concentrations during the first monitoring event were low (peak 0.8%v/v). As per WS02 and WS03, this methane concentration is considered to be characteristic of the sites' gas regime.

However, during subsequent monitoring events elevated peak methane concentrations of up to 68.4%v/v were recorded. These initial peak methane concentrations were short-lived, stabilising after 90 to 120 seconds at peak 15.6%v/v during Visit 2 (14 June 2024) and more typically at between 2.2%v/v to 1.2%v/v during subsequent monitoring events (Visits 3, 4, 5 and 6).

Per the discussion provided in Section 3.4.1 with regard to 'Flow', the methane concentrations recorded in WS06 are considered to be a direct result of the bailing which was completed during Visit 1 (5 June 2024). This has disturbed the water column and increased sediment load, which then degrades to produce small volumes of methane and/or carbon dioxide. The gas is trapped within the artificial orifice created by the flooded standpipes' limited response zone. However, there is no on-going generation, such that the volume of gas quickly dissipates.

Accepting the above, methane concentrations at this site are consistently low (typically not exceeding 1%v/v).

3.4.3 Carbon Dioxide

Table 5c. Summary of Gas Monitoring Information, Carbon Dioxide (CO₂)

Exploratory Hole ID	Response Zone Partially Flooded?	Peak CO ₂ (%v/v)	Steady CO ₂ (%v/v)	Peak CO ₂ (%v/v)	Steady CO ₂ (%v/v)	Peak CO ₂ (%v/v)	Steady CO ₂ (%v/v)	Peak CO ₂ (%v/v)	Steady CO ₂ (%v/v)	Peak CO ₂ (%v/v)	Steady CO ₂ (%v/v)	Peak CO ₂ (%v/v)	Steady CO ₂ (%v/v)
		5/6/24* Visit 1		14/6/24 Visit 2		21/6/24 Visit 3		25/6/24 Visit 4		1/7/24 Visit 5		10/7/24	
WS02	No	10.2	10.2	11.1	11.1	11.8	11.8	10.8	10.8	10.8	10.8	10.9	10.9
WS03	No	3.1	3.1	3.9	3.9	6.0	2.3	4.0	4.0	5.2	5.2	6.8	6.8
WS06	Yes	0.5	0.4	6.5	2.7	9.1	3.0	8.7	3.4	14.0	1.4	12.0	2.2
Notes: * WS06 groundwater bailed after visit 5 June 2024 due to response zone being flooded. Steady readings are indicated to be typically recorded at 90 to 120 seconds.													

WS02, WS03 and WS06 have consistently recorded slightly elevated concentrations of carbon dioxide, peak 11.8%v/v, 6.8%v/v and 14.0%v/v respectively.

Again, the effects of the bailing completed 5 June 2024 (Visit 1) can be seen in the subsequent carbon dioxide monitoring data for WS06 via the short-lived peak concentrations and reduced steady state concentrations recorded. However, overall, the presence of slightly elevated carbon dioxide is consistent with encountered ground conditions, whereby the introduction of oxygen during the drilling process results in enhanced aerobic degradation of local organic content and the generation of carbon dioxide.

3.4.4 Oxygen

Table 5d. Summary of Gas Monitoring Information, Oxygen (O₂)

Exploratory Hole ID	Response Zone Partially Flooded?	Peak O ₂ (%v/v)	Steady O ₂ (%v/v)	Peak O ₂ (%v/v)	Steady O ₂ (%v/v)	Peak O ₂ (%v/v)	Steady O ₂ (%v/v)	Peak O ₂ (%v/v)	Steady O ₂ (%v/v)	Peak O ₂ (%v/v)	Steady O ₂ (%v/v)	Peak O ₂ (%v/v)	Steady O ₂ (%v/v)
		5/6/24* Visit 1		14/6/24 Visit 2		21/6/24 Visit 3		25/6/24 Visit 4		1/7/24 Visit 5		10/7/24 Visit 6	
WS02	No	8.0	8.0	8.8	8.8	8.5	8.8	12.1	12.1	13.3	13.3	10.3	10.3
WS03	No	16.6	16.6	15.7	15.7	13.0	19.0	16.2	16.2	15.1	15.1	13.0	13.0
WS06	Yes	20.2	20.2	11.9	16.4	8.9	19.1	10.9	19.1	<0.1	20.2	4.5	19.9
Notes: * WS06 groundwater bailed after visit 5 June 2024 due to response zone being flooded. Steady readings are indicated to be typically recorded at 90 to 120 seconds.													

WS02, WS03 and WS06 have consistently recorded slightly depleted concentrations of oxygen. Such conditions occur in response to the presence of organic material – the microbial degradation of which produces slightly elevated methane and/or carbon dioxide and depletes oxygen concentrations.

3.4.5 Summary of Ground Gas Conditions

The credible gas monitoring data obtained by Element, 2024 is consistent with encountered ground conditions, whereby slightly elevated methane (~1%v/v) and carbon dioxide (~12%v/v) has been recorded in boreholes which targeted Made Ground and/or Tidal Flat Deposits that recorded organics / Peat. However, consistent with these source materials, there is no evidence of any sustained gas generation under pressure (steady credible flow rates <0.1l/hr).

With regard to WS06, data quality issues have been identified which result in this monitoring data not providing a reliable indicator of gas risk.

3.5 Contamination

During the intrusive works, anthropogenic inclusions (predominantly brick, clinker and concrete) were noted within the Made Ground, although there is no indication of visual or olfactory contamination with the exploratory hole log sheets.

Consistent with the above, soil phase chemical testing identified only the local presence of elevated PAH compounds (benzo(a)pyrene and dibenzo(a,h)anthracene) when compared to adopted screening criteria for site assessment based on a 'residential with plant uptake' end-use.

The above PAH compounds are not volatile and thus the results of the soil phase chemical testing do not indicate any vapour phase risks at this site.

4 Gas Risk Assessment

Per the approach outlined in BS8485:2015+A1:2019 – Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings, the following approach has been adopted by MEC for assessing gas risks:

1. Data quality has been reviewed;
2. Hazardous gas flow rates (Q_{hg}) have been calculated;
3. A worst-case conditions review has been completed and Gas Screening Value (GSV) determined.

This process is summarised below.

Step 1. Data Quality Review

Throughout this report MEC has reviewed the lines of evidence provided via the Phase 1 and Phase 2 works to inform the assessment of ground gas risks. Key to MEC's report is that:

- No credible off-site sources of ground gas have been identified;
- On-site credible sources of ground gas comprise Made Ground (with low degradable organic content) and Tidal Flat Deposits (which contain organics and Peat). Both these potential sources are qualitatively assessed to have 'Very Low to Low' gas generation potential and pose 'Very Low to Low' level of risk to on-site development;
- The proposed foundation construction (case driven piles grouted with concrete slurry and terminated to reinforced concrete ground beams) will form an intimate contact with the Tidal Flat Deposits and not create preferential vertical pathways for gas mitigation;
- The constructed response zones for monitoring are considered acceptable, targeting the primary source of ground gas below the proposed residential buildings and providing adequate spatial / temporal coverage;
- Gas monitoring data collected from none-flooded wells (WS02 and WS03) confirms that the Made Ground and Tidal Flat Deposits are not producing large volumes of methane and/or carbon dioxide under pressure; and
- Where gas monitoring data has been collected from the partially flooded well of WS06, data quality concerns arise because of the limited headspace at the monitoring location, compounded by the action of bailing the position during Visit 1. However, even at this position, peak flow rates and/or methane concentrations are not sustained – quickly dissipating over the period of each monitoring event.

Overall, and whilst the data quality issues at WS06 are recognised, the lines of evidence presented are considered sufficient to robustly assess gas risk and associated mitigation requirements.

Step 2. Calculation of Hazardous Gas Flow Rates (Qhg)

Clause 6.3.4 of the British Standard states that Qhg should be calculated on a visit by visit, borehole by borehole basis, clarifying that:

“The maximum [methane / carbon dioxide] concentration recorded during the monitoring event should be used, unless the use of lower values can be justified, together with steady state values of gas flows.”

Per Section 3.4, MEC has demonstrated that:

- Monitoring locations WS02 and WS03 consistently recorded <0.1%v/v methane so the utilisation of peak / steady concentrations is irrelevant for Qhg calculation.
- At WS06, the peak methane concentrations recorded during monitoring visits 14 June 2024, 21 June 2024, 25 June 2024, 1 July 2024 and 10 July 2024 have been influenced by bailing of WS06 after the first monitoring event (5 June 2024). Reflecting this, it is justified to use steady methane concentrations for the WS06 Qhg calculations.
- Monitoring locations WS02, WS03 and WS06 recorded relatively consistent carbon dioxide concentrations, so maximum concentrations have been adopted for Qhg derivation.
- Per the British Standard, steady flow rates have been used for Qhg derivation. These were all <0.1l/hr except for WS06 on 14 June 2024, when it was reported that the steady flow rate fluctuated between <0.1l/hr and 3.9l/hr every 10 to 15 seconds. The fluctuating nature of the flow indicates it is not a steady flow and was still very likely being influenced by the bailing of this location which had occurred on 5 June 2024. However, it has been adopted for the Qhg calculation.

The calculated Qhg are summarised in Table 6.

Table 6. Calculated Qhg

Date	Position	Steady Flow (l/hr)	Steady Methane (%)	Qhg Methane (l/hr)	Peak Carbon Dioxide (%)	Qhg Carbon Dioxide (l/hr)
05/06/2024	WS02	0.1	0.1	0.00	10.2	0.01
14/06/2024	WS02	0.1	0.1	0.00	11.1	0.01
21/06/2024	WS02	0.1	0.1	0.00	11.8	0.01
25/06/2024	WS02	0.1	0.1	0.00	10.8	0.01
01/07/2024	WS02	0.1	0.1	0.00	10.8	0.01
10/07/2024	WS02	0.1	0.1	0.00	10.9	0.01
05/06/2024	WS03	0.1	0.1	0.00	3.1	0.00
14/06/2024	WS03	0.1	0.1	0.00	3.9	0.00
21/06/2024	WS03	0.1	0.1	0.00	6.0	0.01
25/06/2027	WS03	0.1	0.1	0.00	4.0	0.00
01/07/2024	WS03	0.1	0.1	0.00	5.2	0.01
10/07/2024	WS03	0.1	0.1	0.00	6.8	0.01
05/06/2024	WS06	0.1	0.4	0.00	0.5	0.00
14/06/2024	WS06	3.9	15.6	1.72	6.5	0.25
21/06/2024	WS06	0.1	2.2	0.04	9.1	0.01
25/06/2024	WS06	0.1	0.5	0.03	8.7	0.01
01/07/2024	WS06	0.1	1.1	0.07	14.0	0.01
10/07/2024	WS06	0.1	1.2	0.05	12.0	0.01

Per Table 6:

- Methane Maximum Qhg = 1.72l/hr, equivalent to CS3 per Table 2 of British Standard.
- Carbon Dioxide Maximum Qhg = 0.25l/hr, equivalent to CS2 per Table 2 of British Standard.

All other monitoring boreholes and monitoring events recorded Qhg's <0.07l/hr, which is below the CS1 Threshold per the British Standard.

Step 3. Worst Case Assessment & Gas Screening Value Determination

Per the data quality review outlined in Step 1, a worst-case site assessment using maximum peak gas concentrations in combination with maximum flow rates is not considered appropriate or justified at this site due to data quality issues associated with WS06.

Additional monitoring at this site would not resolve the above – WS06 would very likely remain partially flooded and any additional wells constructed would very likely encounter the same issue.

Instead, it is recommended that a precautionary approach to gas risk mitigation is adopted and the site is defined as CS3 per the British Standard. This reflects:

1. The maximum Qhg calculated for the site (see 'Step 2'); and
2. The guidance provided in Table A1 of CLAIRE Research Bulletin 17⁴, whereby at sites where the ground gas source comprises a nominal mantle of Made Ground over natural soils with high organic content (e.g. Peat) these can be assessed as CS3 without the need for gas monitoring.

⁴ Contaminated Land: Application in Real Environments. A Pragmatic Approach to Ground Gas Risk Assessment (CLAIRE, 2012)

5 Gas Mitigation Design & Materials

5.1 Scope of Protection

Based on a CS3 gas risk classification, design requirements for the development are summarised in Tables 7 and 7a.

Table 7. Summary of Gas Mitigation Design Requirements – Per BS8485:2015+A1:2019

Parameter	Requirement	BS 8485	Discussion / Rationale
CS Classification	CS-3	Table 2	See discussion in Chapters 2, 3 and 4.
Building Class	Type A	Table 3	Detached private residential dwellings.
Gas Protection Score Requirement	4.5 Points	Table 4	-

Table 7a. Specific Mitigation – Houses & Detached Garages

Ground Gas Mitigation – Gas Protection Score Allocation			
Structural Barrier	0.0 Score	Table 5	Per Section 1.3, suspended segmental slab.
Ventilation	2.5 Score	Table 6	Per Section 1.3, clear void proposed below floor slab construction, achieving ‘very good’ performance over relatively small footprint of proposed structures, deemed to comply per Figure 4.2 of NHBC’s NF94 publication.
Gas Resistant Membrane	2.0 Score	Table 7	Gas resistant membrane to be incorporated within floor slab makeup, compliant with the criteria listed in Table 7 of the British Standard - see Section 5.4.
Total Score	Total 4.5 Gas Protection Points Achieves ‘Gas Protection Score Requirement’ (Table 7) 		

5.2 Sub-Slab Venting – Houses

A 200mm deep clear (open) void will be provided below the beam and block floor slab to all residential houses (Plots 1 to 5 inclusive).

Per England Buildings Regulations – Approved Document C⁵, the void will be vented.

Ventilation Markups are provided in Appendix B for the residential houses (Plots 1 to 5 inclusive).

The Ventilation Markups show the location of required telescopic air bricks and cross-venting to sleeper walls. The provisions exceed the requirements of England Building Regulations Approved Document Part C and may be summarised as follows:

- The sub-slab void will be vented by telescopic vents terminated to air bricks constructed per the Ventilation Markups, each providing a ventilation area of >6,000mm²;
- Cross vents to all sleeper walls will be constructed per the Ventilation Markups comprising missed blockwork, each providing >6,000mm² ventilation area; and
- The bottom of the air bricks will be constructed at least one brick course above finished ground level (150mm to top of air brick).

5.3 Sub-Slab Venting – Garages

A 200mm deep clear (open) void will be provided below the beam and block floor slab to all garage structures.

Ventilation Markups are provided in Appendix B for the garages (Plots 1, 3 and 5).

The void will be vented via:

- Telescopic vents terminated to air bricks constructed on opposing building elevations (selected to prevent compartmentalisation by sleeper walls), positioned at maximum 2m spacings, each providing a ventilation area of >6,000mm²; and
- The bottom of the air bricks will be constructed at least one brick course above finished ground level (150mm to top of air brick).

⁵ The Building Regulations 2010 – Site Preparation & Resistant to Contaminants and Moisture.

5.4 Gas Resistant Membrane – Houses & Garages

A gas resistant membrane will be incorporated into the floor slab construction to all structures – houses and garages as follows:

- The block and beam construction will be prepared prior to laying of the gas resistant membrane, such that the substrate comprises a clean, dry, uniform and smooth surface, free from concrete snots, debris/detritus, ponded water and contamination (oil, grease etc.). Any open voids (>12mm deep or wide) to be filled and trowel smoothed before installation of the gas resistant membrane.
- The gas resistant membrane will be continuous across the full extent of the floor slab construction, constructed on top of the block and beam floor, below the insulation (houses) and/or below the screed (garages). The gas resistant membrane will span the cavity, with a robust cavity tray construction above, both terminated onto the external leaf brickwork and sealed to each other using double sided tape (or an equivalent system sealant).
- Table 7 of BS8485:2015+A1:2019 requires specification of a gas resistant membrane which is sufficiently impervious to gas migration, sufficiently strong to withstand the construction process, sufficiently durable to remain serviceable during building occupation, capable of providing a barrier to gas entry and verified in accordance with CIRIA Report C735⁶.
- Scenic Homes has Contracted MB Membranes Limited to install the proprietary gas resistant membrane. MB Membranes Limited propose to use:
 - Perimeter & Internal Load Bearing Walls: JUTA GP DPC (<https://juta.co.uk/gas-protection-membranes/ground-gas-membranes/gp-dpc/>); and
 - Infill: JUTA GP5 (<https://juta.co.uk/gas-protection-membranes/ground-gas-membranes/gp-5/>)

- The above are considered acceptable on the basis of the material properties listed in Table 8.

Note: Should alternative product(s) be proposed, Technical Data Sheet(s) and British Board of Agrément (BBA) Certificate(s) should be provided to MEC for review / comment / approval not less than 6-weeks prior to works proceeding on site. The properties of any alternate materials must be demonstrated via provided laboratory test data to achieve (or exceed) the properties set out in Table 8.

- All joints to the gas resistant membrane are to be heat welded with minimum 100mm overlap (also see Section 6.4).
- Detailing will be completed via the application of Self Adhesive [gas resistant] Membrane (SAM), heated and rolled (pressure applied) to achieve acceptable adhesion. All ancillary detailing products will be Manufacturer approved accessories to the sheet membrane product, e.g. JUTA GP1 SAM.

⁶ CIRIA Report C735 – Good Practice on the Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases (CIRIA, 2014).

- Following verification of the infill gas mitigation, the gas resistant membrane will be protected from damage by follow on trades. The protection will comprise the insulation board to the floor slab construction of the residential houses and/or the concrete screed to the garage structures.
- All materials/products/accessories must be handled, stored and installed in full accordance with the Technical Data Sheets and/or Manufactures requirements.

Material data sheets for the components of the gas membrane construction are provided in Appendix C.

Table 8. Material Properties – Gas Resistant Membrane

Property	Test Method	Minimum Requirement Perimeter	Minimum Requirement Infill
Material & Form	-	Low Density Polyethylene (LDPE).	Multi-layer composite of virgin polyethylene (PE).
Warranty	-	60 Years +	60 Years +
Thickness	EN 1849-2	0.8mm	0.4mm
Weight	EN 1849-2	730g/m ²	400g/m ²
Methane Gas Permeability	BS EN ISO 15105-1	33.9ml/m ² /day/atm	0.12ml/m ² /day/atm
Carbon Dioxide Permeability	BS EN ISO 15105-1	-	1.53ml/m ² /day/atm
Resistance to Static Load	EN 12730	>20kg	>20kg
Tensile Strength – MD Tensile Strength – CMD	EN 12311-2 (A)	24N/mm ² 22N/mm ²	>300N/50mm >300N/50mm
Impact Resistance	EN 12691-B	660mm	500mm
Puncture Resistance	EN 12236	-	1.6kN
Resistance to Tearing (Nail Shank) – MD Resistant to Tearing (Nail Shank) – CMD	EN 12310-1	700N 750N	>230N >230N

6 Gas Resistant Membrane Installation Specifics

6.1 Installation Contractor Competency

The gas resistant membrane will be installed by MB Membranes Limited.

The Installation Supervisor for MB Membranes Limited will hold a relevant qualification in the construction of gas protection measures (e.g. NVQ Level 2 in Gas Protection Installation).

6.2 Installer Construction Quality Assurance (CQA)

The Installation Supervisor for MB Membranes Limited will be in attendance 100% of the time and shall maintain daily CQA records. Minimally the CQA sheet shall provide:

- The names of all installation Contractors on site that day;
- Confirmation of the days work area (annotated site plan and/or Plot IDs);
- Confirmation that substrate is appropriate for gas resistant membrane placement per Section 5.4;
- Summary of materials used, including sheet gas resistant membrane / detailing products etc; and
- Brief overview of works completed.

Copies of the Installers CQA sheets are to be provided upon request.

6.3 Installation Schedule – Perimeter and Infill

Sufficient membrane (minimum 150mm) shall be left for jointing purposes of the perimeter and infill membranes. In MEC's experience it is beneficial to provide interim protection of the perimeter membrane using either protection fleece or a sacrificial DPM, although this is provided at the discretion of the Installer. Regardless, care must be taken to ensure that the perimeter membrane is not damaged prior to the infill membrane being constructed. The perimeter membrane will be thoroughly cleaned and (as/if required) repaired, prior to any attempt to weld the infill membrane.

6.4 Jointing Procedure

The jointing procedure used by the Installer will be as follows:

- The gas resistant membrane will be rolled or pulled out onto the prepared substrate (see Section 5.4) and trimmed to size, ensuring that full contact with the substrate is achieved.
- The gas resistant membrane shall be fully supported by the substrate with no bridging / void.
- The next roll of gas resistant membrane shall be placed, ensuring a minimum 100mm overlap.
- The two sheets shall then be heat welded to form the joint between the two sheets.
- Fishmouths or wrinkles at the joint overlaps will be patched with an oval or round patch of the same gas resistant membrane material extending a minimum of 100 mm beyond the defect in all directions.

6.5 Penetrations & Detailing

All penetrations / detailing to the gas resistant membrane shall be sealed with strips of Self-Adhesive [gas resistant] Membrane (SAM).

All SAM strips must be heated to a sufficient temperature to cause bitumen bleed onto the adjoining sheet and vertical of the penetration/detail (pipe, stanchion etc.). Pressure must be applied to the heated SAM in order to ensure adhesion to the receiving surface(s).

6.6 Repair Procedure

Any portion of the gas resistant membrane exhibiting a flaw or failing a visual inspection / non-destructive (physical) test, will require repair. Unless notified in writing otherwise by the Designer, typically SAM patching will be the preferred approach to repair any penetrating holes, tears etc.

In addition, the following provisions will be satisfied:

- All surfaces must be clean, free of all particulate matter, and dry at the time of the repair;
- The repair procedures, materials and techniques will be approved in advance of the specific repair by the Verifier; and
- Patches and will extend at least 100 mm beyond the edge of the defect.

All repairs will be re-inspected by the Verifier. Repairs passing re-inspection will be considered acceptable. Failed repairs will require the repair to be redone and re-inspected until a passing test result is obtained. The Verifier shall note all repairs and re-inspections in the Verifiers' site visit inspection form.

6.7 Weather Conditions

Gas resistant membrane placement shall not take place in an area of ponded water, or during excessive winds.

The recommended maximum and minimum installation temperatures quoted on material manufacturers data sheets should be always adhered to. Special attention should be given to bitumen type self-adhesive products, as in most cases these will have the lowest installation temperature range.

Placement of the gas resistant membrane should not take place in any event when the temperature is below zero degrees, as this will present a health and safety risk to site personnel, in these conditions the gas resistant membrane surface will become too dangerous to walk on.

When laying the gas resistant membrane it is beneficial to proceed in the direction of (with) the prevailing winds. This decision must be made during installation, in accordance with varying environmental conditions. In any event, the Installer will be fully responsible for the decisions made regarding placement procedures.

7 Verification Plan

7.1 Verifier Competence

The Verifier will minimally hold a NVQ Level 4 in Gas Membrane Verification and/or be registered via the CL:AIRE Gas Protection Verification Accreditation Scheme (Technician Level (TGVP) or Specialist Level (SGPV)).

7.2 Verifier Site Attendance

All requests for Verifier inspection/testing site visits must be made in writing not less than 5 working days prior to the required inspection day. It is the responsibility⁷ of the Client / Installer to coordinate all verification visits and ensure sufficient time is allocated such that the required regime of inspection is achieved.

7.3 Verification Frequency and Remit

The installed gas mitigation system will be subject to 100% inspection. The inspection items are as per:

- Table 9a: Passive Sub-Slab Venting - Houses;
- Table 9b: Passive Sub-Slab Venting – Garages; and
- Table 10: Gas Resistant Membrane – Houses and Garages.

Table 9a. Passive Sub Slab Venting – Houses

Item	Inspection Remit	Requirement
Open Void	Ground Worker to confirm depth of open void ¹ .	Minimum 200mm deep.
Sleeper Wall Cross Ventilation	Ground Worker to confirm provision of cross ventilation ¹ .	Missed blockwork providing >6,000mm ² vent area located per Vent Markups in Appendix B.
Air Bricks	Verifier to confirm provision of air bricks.	Constructed per Vent Markups in Appendix B, each providing >6,000mm ² vent area, bottom of air brick constructed at least one brick course above finished ground level (150mm to top of air brick) ² .
Notes: 1. Ground Worker to provide photographic evidence of the void depth and cross-venting to sleeper walls. 2. If the Verifier cannot measure the termination height of the air bricks relative to finished ground level at the time of the verification visits the Ground Worker will be required to provide photographs of the vents relative to the surface finishes as construction works progress.		

⁷ Responsible party to be agreed prior to works commencing.

Table 9b. Passive Sub Slab Venting – Garages

Item	Inspection Remit	Requirement
Open Void	Ground Worker to confirm depth of open void ¹ .	Minimum 200mm deep.
Sleeper Wall Cross Ventilation	N/A	-
Air Bricks	Verifier to confirm provision of air bricks.	Construed per Vent Markups in Appendix B, each providing >6,000mm ² vent area, bottom of air brick constructed at least one brick course above finished ground level (150mm to top of air brick) ² .
Notes: 1. Ground Worker to provide photographic evidence of the void depth. 2. If the Verifier cannot measure the termination height of the air bricks relative to finished ground level at the time of the verification visits the Ground Worker will be required to provide photographs of the vents relative to the surface finishes as construction works progress.		

Table 10. Gas Resistant Membrane Verification Checks – Houses & Garages

Item	Frequency of Inspection ^{1&2}	Requirement
Substrate Preparation	Installer to inspect substrate and confirm it has been prepared appropriately prior to installation of the gas resistant membrane.	See Section 5.4.
Perimeter	Verifier to inspect full extent (100%) of the perimeter gas resistant membrane and confirm continuity across the cavity. Gas resistant membrane to be visually inspected to ensure no holes, rips or tares are present.	See Section 5.4.
Infill	Verifier to conduct a thorough visual inspection of 100% of the installed gas resistant membrane for holes, rips or tares. All (100%) joints/laps/penetrations/detailing to be subject to physical (probe) testing to ASTM D4437.	See Section 5.4.
Notes: 1. It is the responsibility of the Client / Installer to co-ordinate verification visits such that 100% of the perimeter and infill gas resistant membrane install is available for inspection. 2. Additional specific requirements for the gas resistant membrane construction are provided in Section 6, which should be read in conjunction with Table 10.		

7.4 Verifiers' Site Visit Inspection Forms

The Verifier will record on the site visit inspection forms:

- All independent visual inspections pertaining to the passive sub-slab venting (air bricks, see Table 9a/9b);
- All independent visual inspections and/or physical testing of the gas resistant membrane (see Table 10);
- All defects / non-compliances to the passive sub-slab venting system (air bricks) / gas resistant membrane and confirm these have been communicated to the Ground Works Contractor (passive sub-slab venting) or Installer (gas resistant membrane);
- Inform the Installer of any required repairs to the gas resistant membrane and oversee these repairs, including oversight of required re-tests (see Section 6.6); and
- Obtain a selection of representative photograph for inclusion in the Verification Inspection Report.

7.5 Defects and Damage

The Verifier will inspect (via a combination of visual observation and physical testing, see Table 10) the gas resistant membrane and detailing areas (pipe penetrations, stanchions etc.), after placement and jointing, for damage. In areas that fail the inspection, the Verifier will inform the Installer who will then be required to complete a repair.

Work will not proceed with any materials which will cover locations that have been identified to require repair until the Verifier has 'passed' the subsequent repair. The number of repairs required will be recorded and presented in the Verification Inspection Report.

Minimally, the Verifier will ensure that:

- The gas resistant membrane is placed in such a manner that it has not been damaged at the point of inspection; and
- Any tears, punctures, holes, thin spots, gouges, and protuberances etc., are repaired.

7.6 Verification Inspection Reporting

A Verification Inspection Report will be produced by the Verifier on completion of the gas mitigation installation and submitted to the Client. Minimally the report will include:

- Reference/Name of Job;
- Scope of Work Undertaken (as per the Verification Remit, see Section 7.3 – Tables 9a/9b and 10);
- Copies of the Verifiers' Site Inspection Forms for all visits;
- Records of any repairs, failures and retests;
- Confirmation of utilised materials and general detailing procedures; and
- Photographic evidence of the general installation observations.

8 Construction Phase Management

8.1 Management of Follow-On Works / Contractors

This 'Gas Protection Design & Verification Plan' sets out the mitigation measures required to manage ground gas risks at the site. Whilst protection to the mitigation has been included within the design, without proper site management, damage could still occur. It is therefore important that:

- Sufficient time is allowed within the build programme for the construction of the ground gas mitigation measures and all associated verification works; and
- Upon installation of the ground gas mitigation, measures are put in place to limit the potential for follow-on damage, which per the guidance provided in CIRIA Report C801 – Hazardous Ground Gases: A Site Management Guide (CIRIA, 2021) include:
 - Prompt (within 2-working days) placement of insulation board on top of the gas resistant membrane to the residential houses (once verification is confirmed);
 - Prompt construction of the screed on top of the gas resistant membrane to the garages (once verification is confirmed);
 - In the intervening period, the installed area(s) of gas resistant membrane should be considered 'clean / restricted work areas', with no dirty boots, no storage of materials/equipment/waste etc. and no trafficking of machinery permitted; and
 - The use of sharp tools and/or cutting activities should not be completed on top of the gas resistant membrane. If unavoidable, the Verifier should be informed and the area reinspected following completion of the activity.

The measures outlined above should limit the potential for damage to the gas membrane. However, should MEC identify post-verification damage to the constructed gas membrane which results from the membrane not being promptly protected we reserve the right to require 'picture framing' (i.e. infill over-bridging with a new sheet of membrane) of the damaged area. In any event, should damage occur to the gas resistant membrane this should be notified immediately to the Installer and Verifier for repair and reinspection.

8.2 Sealing of Service Ducts

All service ducts should be sealed. The responsibility for this is with the Ground Worker, or their appointed designate. Sealing of individual flexible cables and/or ducted cable bundles can be difficult to achieve and, where possible, should be avoided by design. A proprietary sealant system should be utilised for the sealing of all ground level ducts, e.g. <https://juta.co.uk/gas-protection-membranes/gp-ductseal-hg/> (material data sheet provided in Appendix C). Where/as required, duct sealing systems should be approved by statutory utility service provider(s).

8.3 Fixings Through Gas Membrane

Fixings through the gas resistant membrane are not permitted. If unavoidable a sealing gasket detail should be agreed with MEC prior to works proceeding.

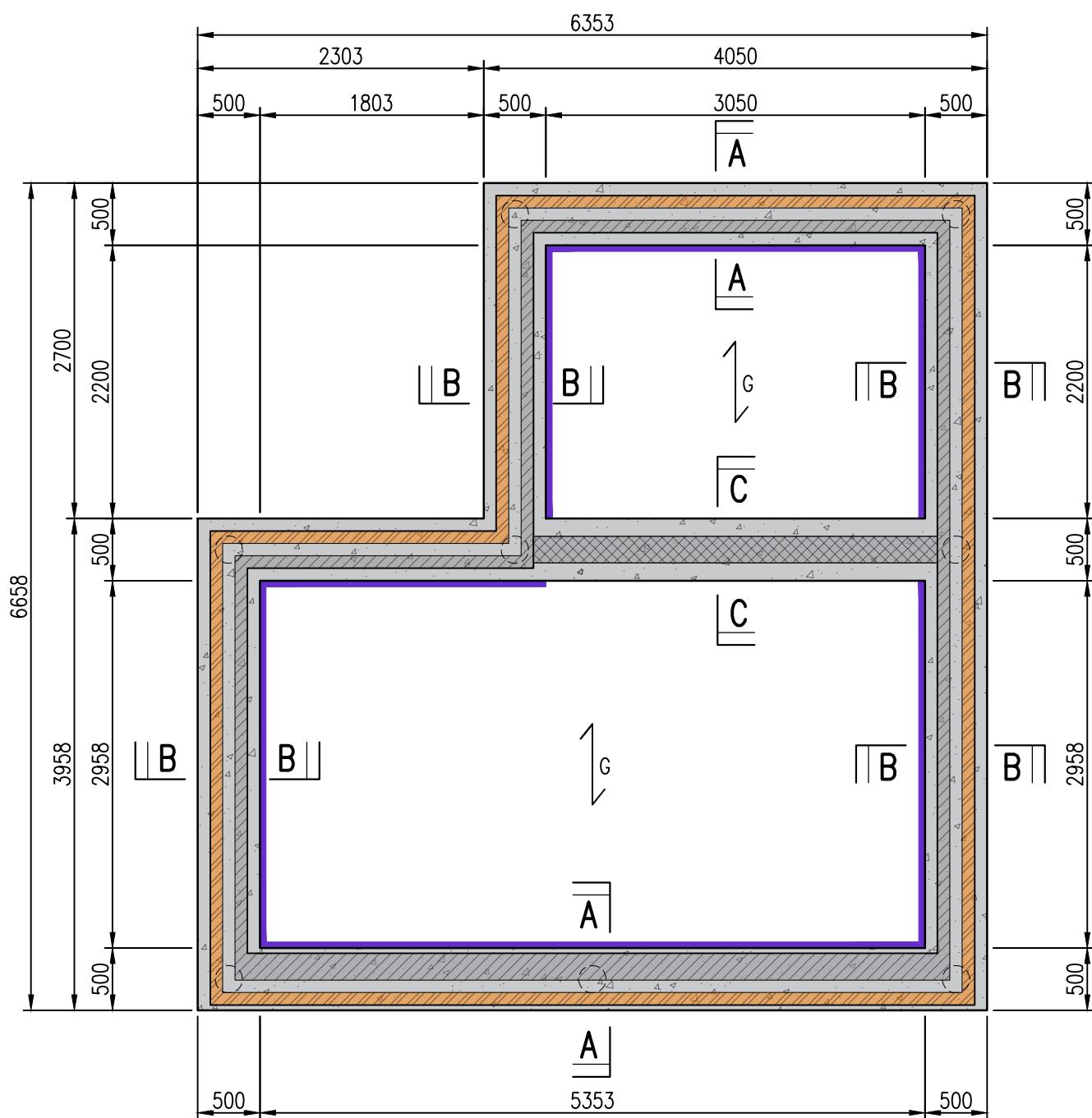
9 Health and Safety

The proposed site of the residential development is located on organic rich ground. The potential for ground gas (primarily elevated methane / carbon dioxide and depleted oxygen) should be noted to all Contractors. All below ground activities should be accompanied by Risk Assessments and Method Statements which recognise the potential hazard(s) associated with ground gases and set out the controls which will be put in place to manage the associated risk during the construction phase.

10 Regulatory Approvals

It is the responsibility of the Client (or their appointed Planning Consultant) to submit a copy of this Gas Protection Design and Verification Plan for approval to the Local Authority (as/if required per Planning Conditions) and any development Warranty Provider. **It is strongly recommended that the contents of this report are not acted on until approval has been obtained.**

Appendix A – Development Drawings

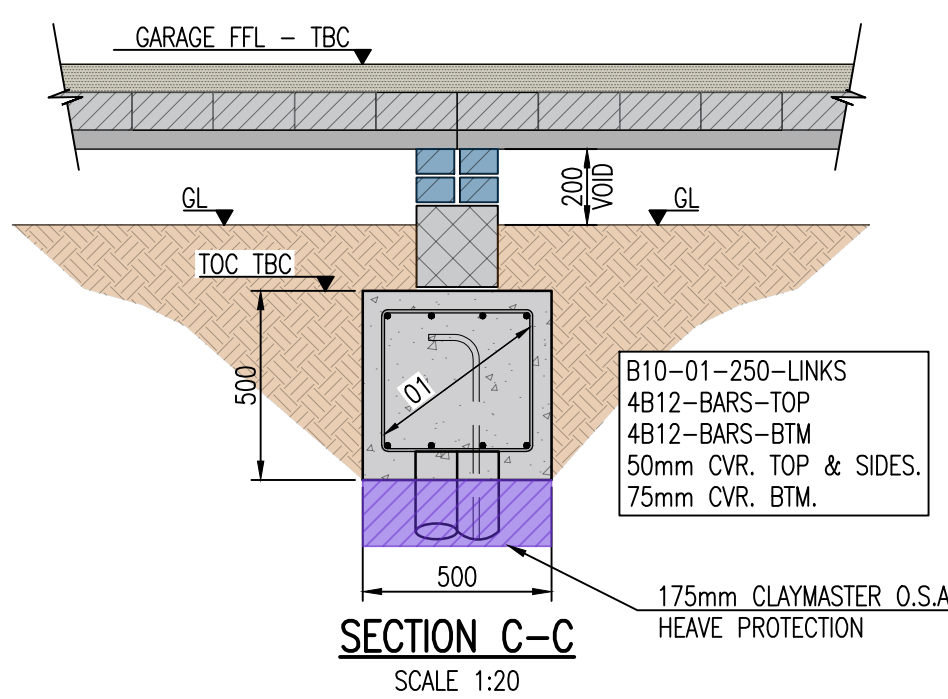
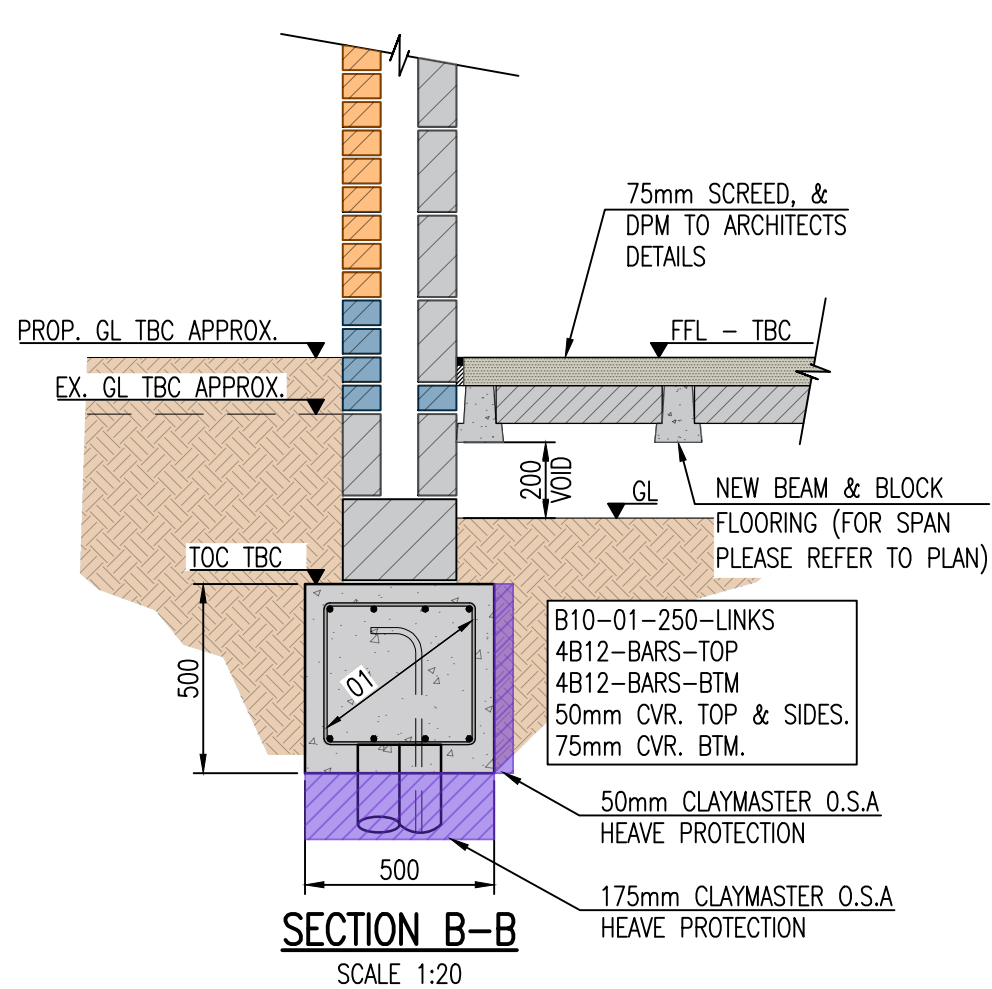
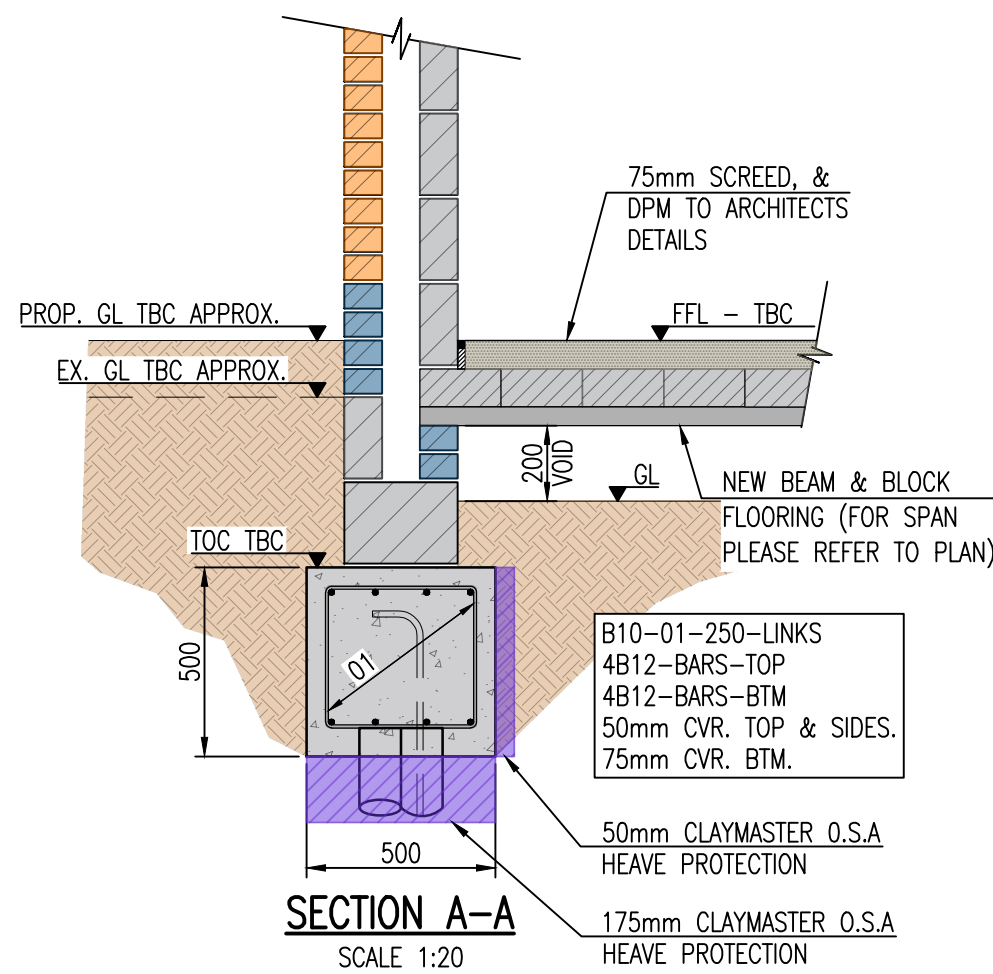


Key:

- DENOTES OUTER LEAF MASONRY
- DENOTES INNER LEAF MASONRY
- DENOTES STUDWORK WALLS
- DENOTES 215 THK. SLEEPER WALL
- DENOTES SPAN OF GROUND FLOOR BEAM & BLOCK FLOORING DESIGNED BY MANUFACTURER
- DENOTES HEAVE PROTECTION

LOADINGS:
BEAM & BLOCK – S/W BY MANUFACTURER
IMPOSED – 1.5kN/m²
BLOCKWORK PARTITIONS – 5.0 kN/m LINE LOAD
FINISHES – 1.80kN/m²
GARAGE IMPOSED – 2.50kN/m²

PROPOSED GROUNDBEAM FOUNDATION ARRANGEMENT
PLOT 1 GARAGE
SCALE 1:50

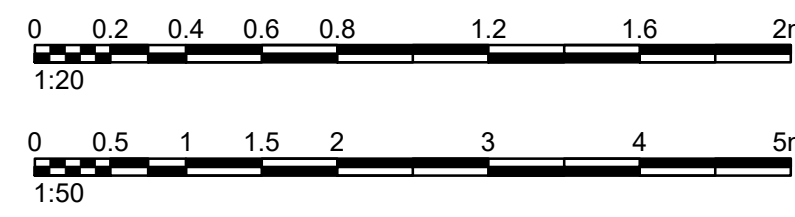


PLEASE REFER TO ARCHITECTS DRAWINGS FOR
CONFIRMATION OF ALL WALL/SETTING OUT
DIMENSIONS PRIOR TO COMMENCING OF WORKS

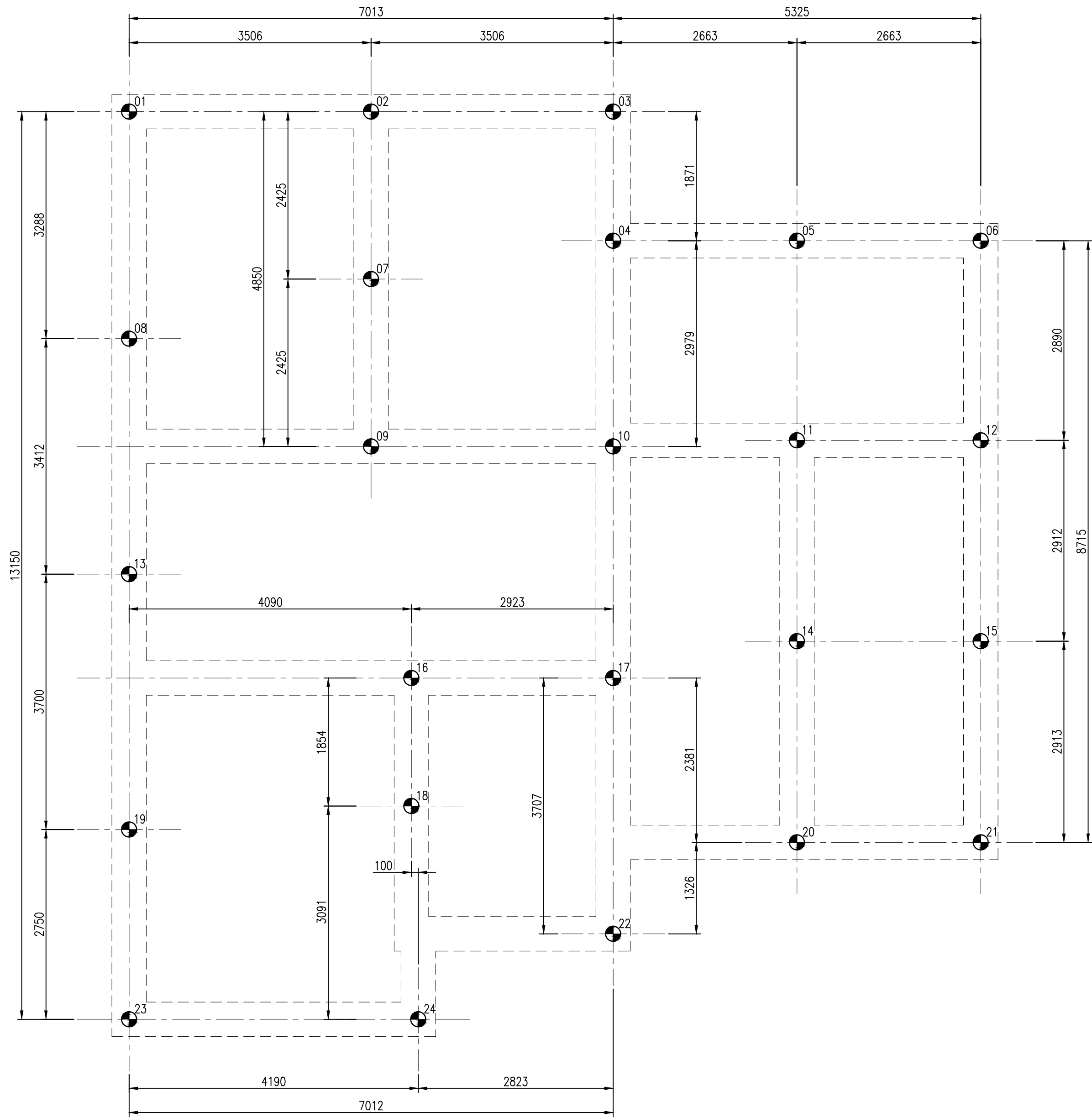
THIS DRAWING MUST BE READ IN CONJUNCTION
WITH ALL RELEVANT DRAWINGS & STRUCTURAL
CALCULATIONS

GROUNDBEAM SPECIFICATION

- CONCRETE TO BE DS-2, DC-2, ACEC-2 TO BS 8500.
- REINFORCED CONCRETE FOUNDATIONS TO BE MINIMUM GRADE C28/35 WITH A MINIMUM O.P.C. CONTENT OF 300 KG/m³ AND A WATER CEMENT RATIO OF 0.6. RC 28/35 TO BS 8500
- COVER TO BE 75mm BTM, 50mm TOP & SIDES.
- SHOULD SURFACE/GROUND WATER ENTER THE EXCAVATIONS PRIOR TO BLINDING WITH CONCRETE, THE THE BOTTOMS ARE TO BE REFORMED TO THE SATISFACTION OF THE ENGINEER.
- REINFORCING BARS (GRADE 500B), AND MESH FABRIC TO BE HIGH YIELD BAR IN ACCORDANCE WITH BS 4461 AND BS 4483 RESPECTIVELY.
- MINIMUM LAP TO REINFORCING BARS TO BE 40 TIMES BAR DIA.
- MINIMUM LAP TO MESH FABRIC TO BE 350mm.
- ALL REINFORCED CONCRETE TO BE COMPACTED USING AN IMMERSION VIBRATOR TO EXPELL TRAPPED AIR AND FORM A CONSISTENT DENSE MATERIAL.
- NO CONCRETE TO BE POURED IF AMBIENT TEMPERATURE IS LESS THAN 5 DEGREES CENTIGRADE.



—	PRELIMINARY – FOR APPROVAL	MRB	JL	16.02.24	
REV.	DESCRIPTION	DRN.	APP.	DATE	
SHIELDS WILSON e: info@shieldswilson.co.uk t: 01775 729252 STRUCTURAL AND CIVIL ENGINEERING					
STATUS FOR INFORMATION					
CLIENT SCENIC HOMES LTD.					
PROJECT 5 PLOTS ADJACENT 128 BARRIER BANK COWBIT, SPALDING, Lincs.					
TITLE PLOT 1 GARAGE PROPOSED GROUNDBEAM ARRANGEMENT & DETAILS					
DATE	FEB. '24	SCALE 1:50	DRAWING NO.	REV.	
DRAWN	MRB	1:20	SW22-170-219	—	

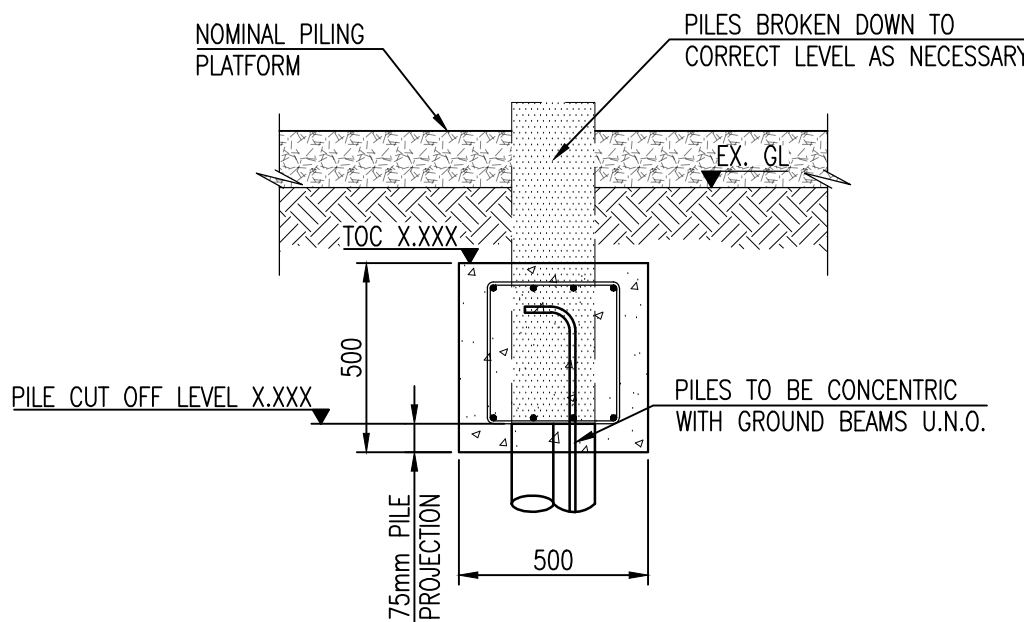


PROPOSED PILING ARRANGMENT
SCALE 1:50

Key:

DENOTES PILE WITH A
200kN SWL CAPACITY U.N.O.

PILE CUT OFF LEVEL X.XXX



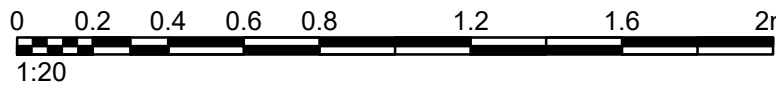
TYPICAL SECTION THROUGH GROUND BEAM
SCALE 1:20

PLEASE REFER TO ARCHITECTS DRAWINGS FOR
CONFIRMATION OF ALL WALL/SETTING OUT
DIMENSIONS PRIOR TO COMMENCING OF WORKS

THIS DRAWING MUST BE READ IN CONJUNCTION
WITH ALL RELEVANT DRAWINGS & STRUCTURAL
CALCULATIONS

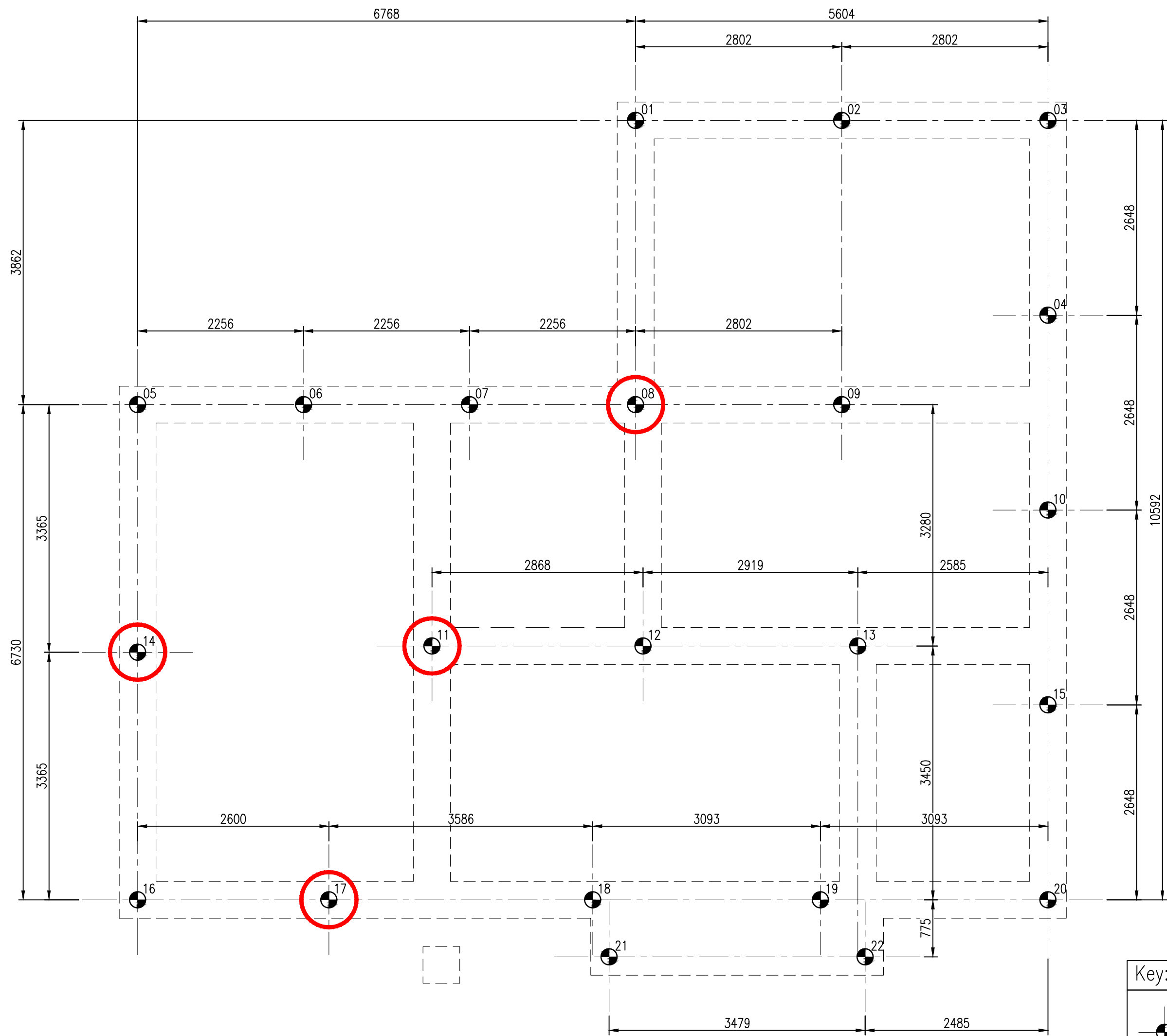
PILING NOTES

- ALL PILES TO BE DESIGNED BY SPECIALIST PILING CONTRACTOR.
- PILES ARE TO BE DESIGNED FOR LOADS GIVEN ON THE DRAWING WITH A MINIMUM FACTOR OF SAFETY OF 3.0
- PILE DESIGN SHALL BE TO THE SATISFACTION OF THE ENGINEER AND THE LOCAL AUTHORITY, AND SHOULD COMPLY WITH THE CURRENT BUILDING REGULATIONS.
- ALL PILES TO HAVE A MINIMUM OF 1 NO B16 PROJECTING RE-BAR 450mm LONG (MINIMUM). THIS MUST BE BENT AND TIED TO THE GROUND BEAM REINFORCING STEEL.
- PROJECTING REINFORCEMENT FROM THE TOP OF PILES SHOULD BE PROJECTED FROM DAMAGE DURING CONSTRUCTION.
- THE DESIGN AND WORKMANSHIP OF THE PILES SHOULD BE IN ACCORDANCE WITH THE CURRENT EDITION OF "SPECIFICATION FOR PILING AND EMBEDDED RETAINING WALLS" BY THE INSTITUTION OF CIVIL ENGINEERS.
- ALL PILES TO PROJECT INTO THE BEAM BY MIN. 75mm.
- EXISTING SERVICES SHOULD BE CHECKED AGAINST PILE LOCATIONS BY THE MAIN CONTRACTOR AND IF NECESSARY DIVERTED PRIOR TO COMMENCEMENT OF PILING.
- PILE LOCATIONS SHOULD BE PROBED WITH 2m LONG REINFORCEMENT BARS TO CHECK FOR OBSTRUCTIONS PRIOR TO PILING WORK COMMENCING. IF OBSTRUCTIONS ARE ENCOUNTERED THAT CANNOT BE EASILY REMOVED, PILING SCHEME TO ALLOW FOR PERCUSSIVE DRILLING THROUGH OBSTRUCTION, TO ALLOW PILING TO CONTINUE TO LOAD BEARING HORIZON.
- PILES INSTALLED OUT OF POSITION IN EXCESS OF 50mm TO BE REPORTED TO THE ENGINEER.



—	PRELIMINARY — FOR APPROVAL	AS	APW	05.09.22
REV.	DESCRIPTION	DRN.	APP.	DATE

SHIELDS WILSON		e: info@shieldswilson.co.uk t: 01775 729262 STRUCTURAL AND CIVIL ENGINEERING	
STATUS FOR INFORMATION			
CLIENT SCENIC HOMES DEVELOPMENTS LTD.			
PROJECT 5 PLOTS, ADJACENT 158 BARRIER BANK, COWBIT, SPALDING, LINGS.			
TITLE PLOT 2 PROPOSED PILING ARRANGEMENT & DETAILS			
DATE	AUG. '22	SCALE 0A1 1:50 1:20	DRAWING NO. SW 22-170-203
DRAWN	AS		REV. -

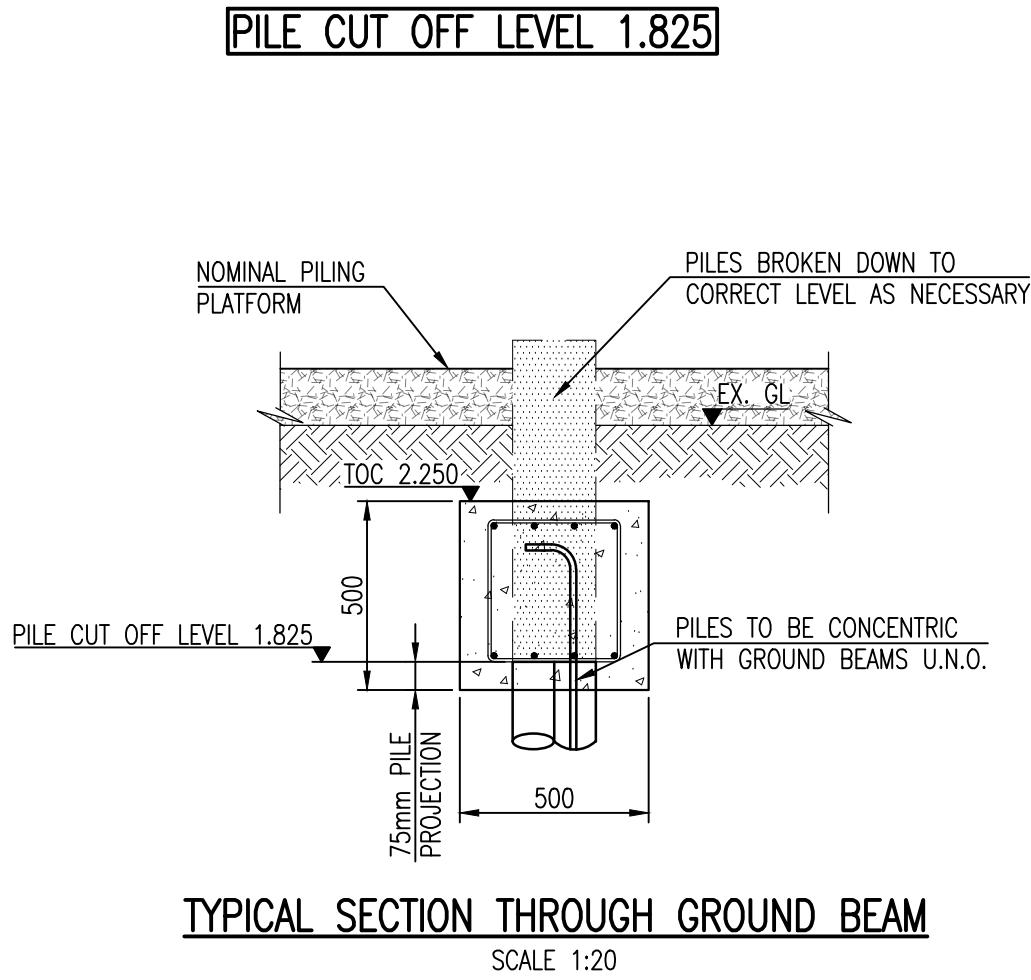


PROPOSED PILING ARRANGMENT
SCALE 1:50

Key:

 DENOTES PILES WITH A 175kN SWL CAPACITY

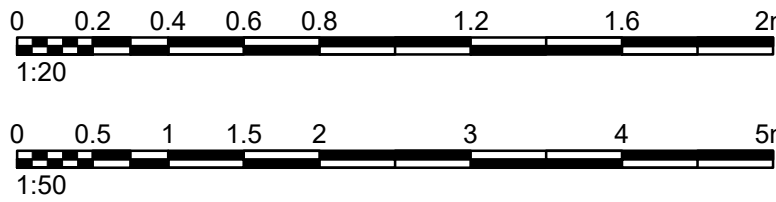
 DENOTES PILES WITH A 225kN SWL CAPACITY



PLEASE REFER TO ARCHITECTS DRAWINGS FOR
CONFIRMATION OF ALL WALL/SETTING OUT
DIMENSIONS PRIOR TO COMMENCING OF WORKS

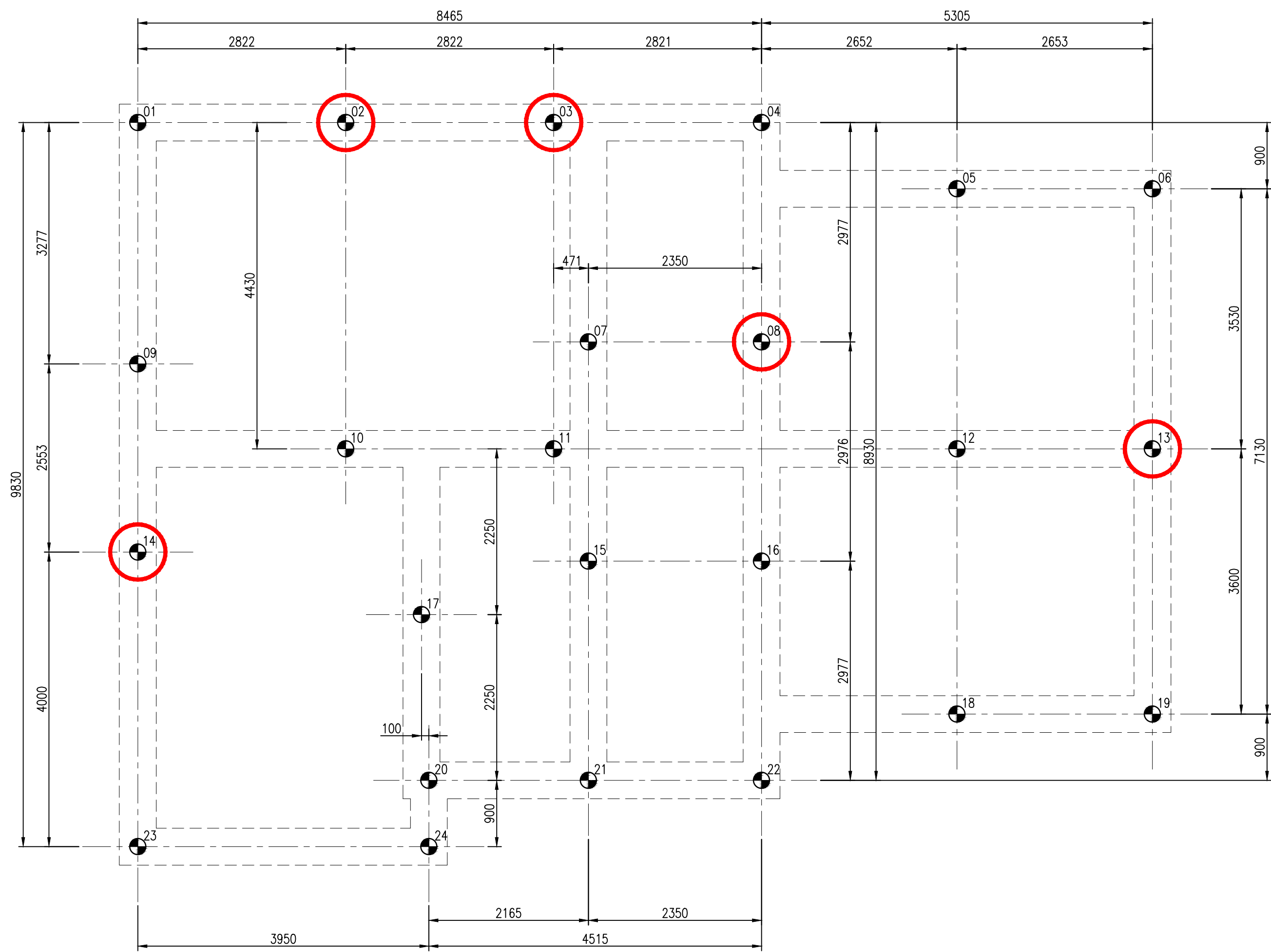
THIS DRAWING MUST BE READ IN CONJUNCTION
WITH ALL RELEVANT DRAWINGS & STRUCTURAL
CALCULATIONS

- PILING NOTES
- ALL PILES TO BE DESIGNED BY SPECIALIST PILING CONTRACTOR.
 - PILES ARE TO BE DESIGNED FOR LOADS GIVEN ON THE DRAWING WITH A MINIMUM FACTOR OF SAFETY OF 3.0
 - PILE DESIGN SHALL BE TO THE SATISFACTION OF THE ENGINEER AND THE LOCAL AUTHORITY, AND SHOULD COMPLY WITH THE CURRENT BUILDING REGULATIONS.
 - ALL PILES TO HAVE A MINIMUM OF 1 NO B16 PROJECTING RE-BAR 450mm LONG (MINIMUM). THIS MUST BE BENT AND TIED TO THE GROUND BEAM REINFORCING STEEL.
 - PROJECTING REINFORCEMENT FROM THE TOP OF PILES SHOULD BE PROJECTED FROM DAMAGE DURING CONSTRUCTION.
 - THE DESIGN AND WORKMANSHIP OF THE PILES SHOULD BE IN ACCORDANCE WITH THE CURRENT EDITION OF "SPECIFICATION FOR PILING AND EMBEDDED RETAINING WALLS" BY THE INSTITUTION OF CIVIL ENGINEERS.
 - ALL PILES TO PROJECT INTO THE BEAM BY MIN. 75mm.
 - EXISTING SERVICES SHOULD BE CHECKED AGAINST PILE LOCATIONS BY THE MAIN CONTRACTOR AND IF NECESSARY DIVERTED PRIOR TO COMMENCEMENT OF PILING.
 - PILE LOCATIONS SHOULD BE PROBED WITH 2m LONG REINFORCEMENT BARS TO CHECK FOR OBSTRUCTIONS PRIOR TO PILING WORK COMMENCING. IF OBSTRUCTIONS ARE ENCOUNTERED THAT CANNOT BE EASILY REMOVED, PILING SCHEME TO ALLOW FOR PERCUSSIVE DRILLING THROUGH OBSTRUCTION, TO ALLOW PILING TO CONTINUE TO LOAD BEARING HORIZON.
 - PILES INSTALLED OUT OF POSITION IN EXCESS OF 50mm TO BE REPORTED TO THE ENGINEER.



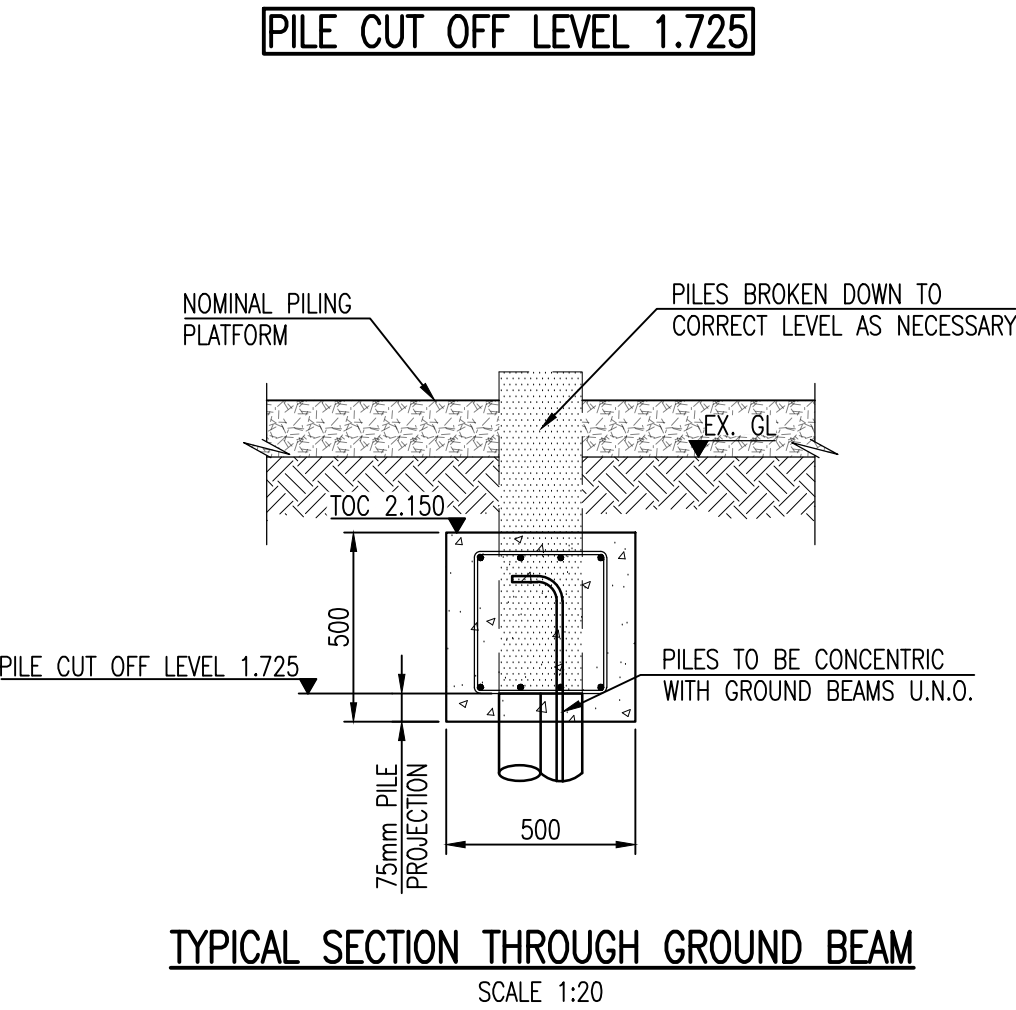
—	PRELIMINARY — FOR APPROVAL	AS	APW	29.09.22
REV.	DESCRIPTION	DRN.	APP.	DATE

SHIELDS WILSON e: info@shieldswilson.co.uk t: 01775 729262 STRUCTURAL AND CIVIL ENGINEERING			
STATUS FOR INFORMATION			
CLIENT SCENIC HOMES LTD.			
PROJECT 5 PLOTS, ADJACENT 128 BARRIER BANK, COWBIT, SPALDING, Lincs.			
TITLE PLOT 3 PROPOSED PILING ARRANGEMENT & DETAILS			
DATE	AUG. '22	SCALE 0A1 1:50	DRAWING NO. SW 22-170-206
DRAWN	AS	1:20	REV. —



PROPOSED PILING ARRANGMENT
SCALE 1:50

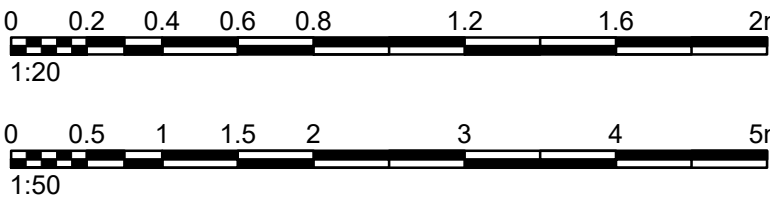
Key:	
	DENOTES PILES WITH A 175kN SWL CAPACITY
	DENOTES PILES WITH A 225kN SWL CAPACITY



PLEASE REFER TO ARCHITECTS DRAWINGS FOR
CONFIRMATION OF ALL WALL/SETTING OUT
DIMENSIONS PRIOR TO COMMENCING OF WORKS

THIS DRAWING MUST BE READ IN CONJUNCTION
WITH ALL RELEVANT DRAWINGS & STRUCTURAL
CALCULATIONS

- PILING NOTES
- ALL PILES TO BE DESIGNED BY SPECIALIST PILING CONTRACTOR.
 - PILES ARE TO BE DESIGNED FOR LOADS GIVEN ON THE DRAWING WITH A MINIMUM FACTOR OF SAFETY OF 3.0
 - PILE DESIGN SHALL BE TO THE SATISFACTION OF THE ENGINEER AND THE LOCAL AUTHORITY, AND SHOULD COMPLY WITH THE CURRENT BUILDING REGULATIONS.
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 - PROJECTING REINFORCEMENT FROM THE TOP OF PILES SHOULD BE PROJECTED FROM DAMAGE DURING CONSTRUCTION.
 - THE DESIGN AND WORKMANSHIP OF THE PILES SHOULD BE IN ACCORDANCE WITH THE CURRENT EDITION OF "SPECIFICATION FOR PILING AND EMBEDDED RETAINING WALLS" BY THE INSTITUTION OF CIVIL ENGINEERS.
 - ALL PILES TO PROJECT INTO THE BEAM BY MIN. 75mm.
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 - PILE LOCATIONS SHOULD BE PROBED WITH 2m LONG REINFORCEMENT BARS TO CHECK FOR OBSTRUCTIONS PRIOR TO PILING WORK COMMENCING. IF OBSTRUCTIONS ARE ENCOUNTERED THAT CANNOT BE EASILY REMOVED, PILING SCHEME TO ALLOW FOR PERCUSSIVE DRILLING THROUGH OBSTRUCTION, TO ALLOW PILING TO CONTINUE TO LOAD BEARING HORIZON.
 - PILES INSTALLED OUT OF POSITION IN EXCESS OF 50mm TO BE REPORTED TO THE ENGINEER.



—	PRELIMINARY – FOR APPROVAL	AS	APW	04.10.22
REV.	DESCRIPTION	DRN.	APP.	DATE

SHIELDS WILSON
e: info@shieldswilson.co.uk t: 01775 729262
STRUCTURAL AND CIVIL ENGINEERING

STATUS
FOR INFORMATION

CLIENT
SCENIC HOMES LTD.

PROJECT
5 PLOTS, ADJACENT 128 BARRIER BANK,
COWBIT, SPALDING, Lincs.

TITLE
PLOT 4
PROPOSED PILING ARRANGEMENT
& DETAILS

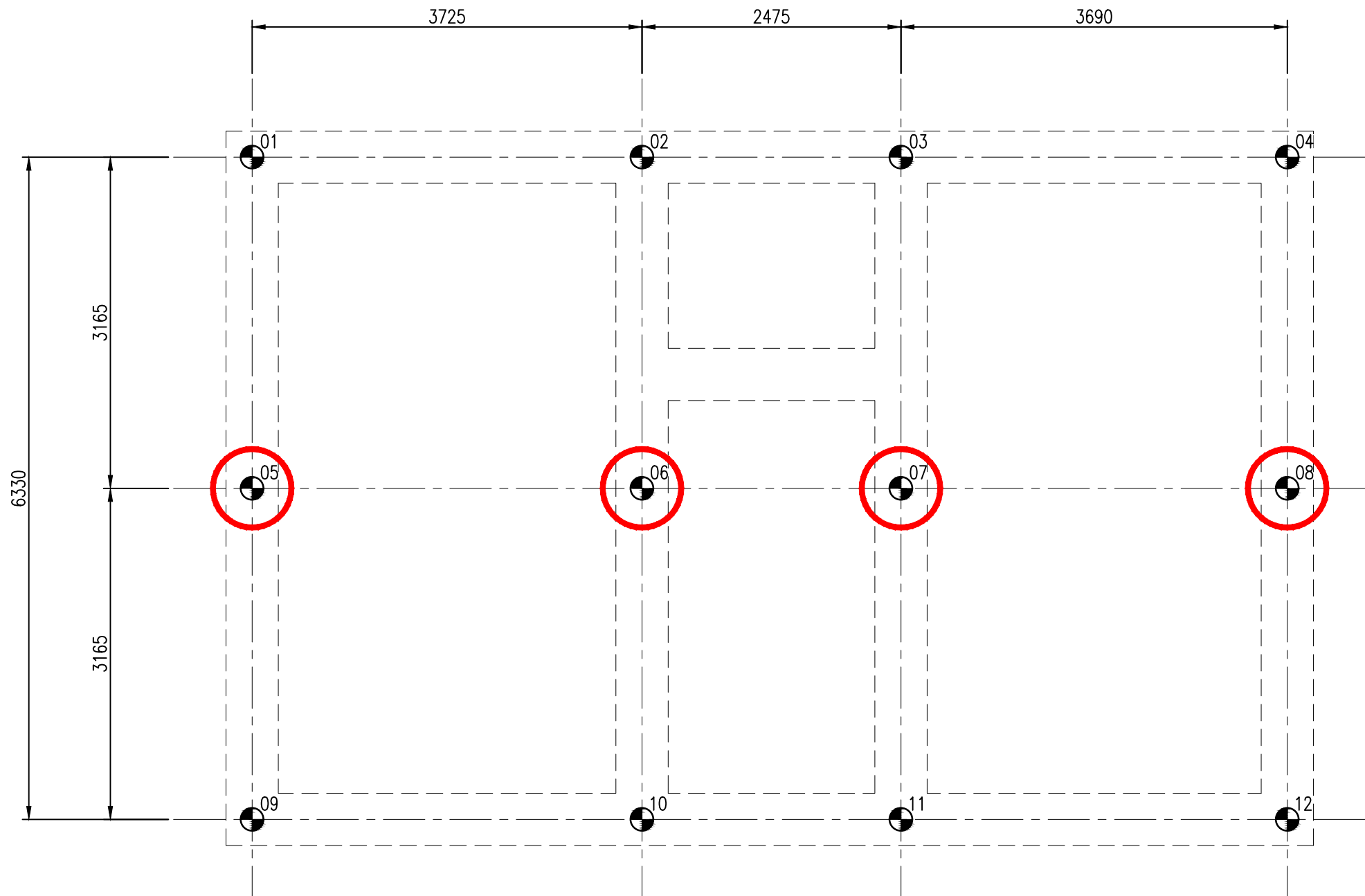
DATE	OCT. '22	SCALE	0A1 1:50 1:20	DRAWING NO.	SW 22-170-209	REV.	—
DRAWN	AS						

PLEASE REFER TO ARCHITECTS DRAWINGS FOR
CONFIRMATION OF ALL WALL/SETTING OUT
DIMENSIONS PRIOR TO COMMENCING OF WORKS

THIS DRAWING MUST BE READ IN CONJUNCTION
WITH ALL RELEVANT DRAWINGS & STRUCTURAL
CALCULATIONS

PILING NOTES

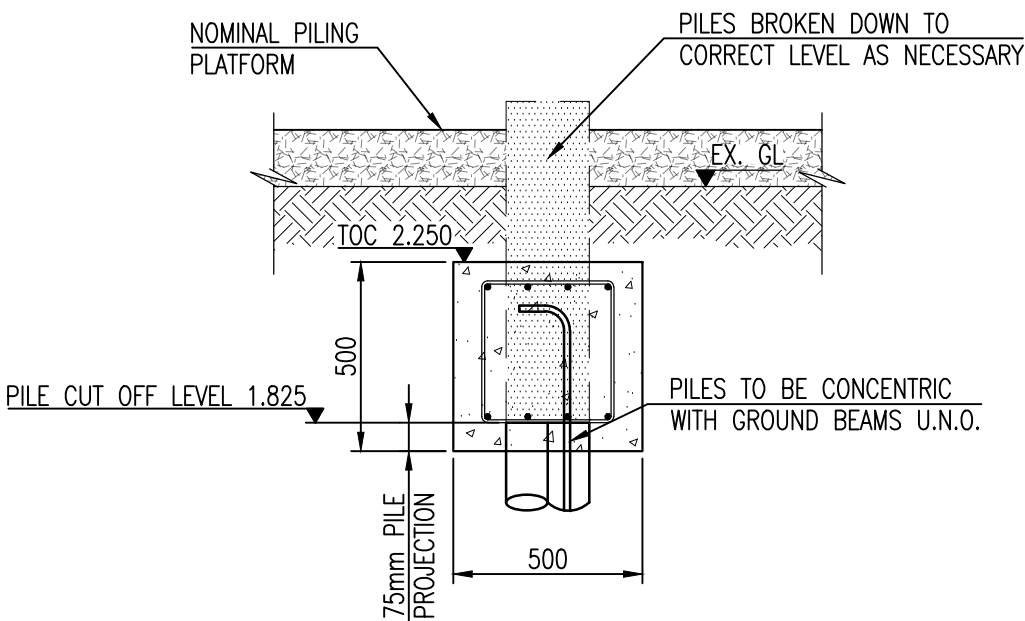
- ALL PILES TO BE DESIGNED BY SPECIALIST PILING CONTRACTOR.
- PILES ARE TO BE DESIGNED FOR LOADS GIVEN ON THE DRAWING WITH A MINIMUM FACTOR OF SAFETY OF 3.0
- PILE DESIGN SHALL BE TO THE SATISFACTION OF THE ENGINEER AND THE LOCAL AUTHORITY, AND SHOULD COMPLY WITH THE CURRENT BUILDING REGULATIONS.
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- PILES INSTALLED OUT OF POSITION IN EXCESS OF 50mm TO BE REPORTED TO THE ENGINEER.



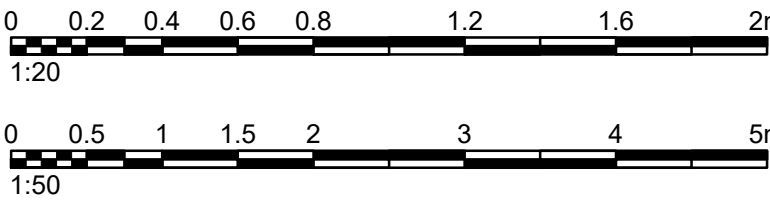
PROPOSED PILING ARRANGMENT
SCALE 1:50

Key:	
	DENOTES PILES WITH A 175kN SWL CAPACITY
	DENOTES PILES WITH A 225kN SWL CAPACITY

PILE CUT OFF LEVEL 1.825



TYPICAL SECTION THROUGH GROUND BEAM
SCALE 1:20



—	PRELIMINARY — FOR APPROVAL	MRB	APW	07.10.22
REV.	DESCRIPTION	DRN.	APP.	DATE

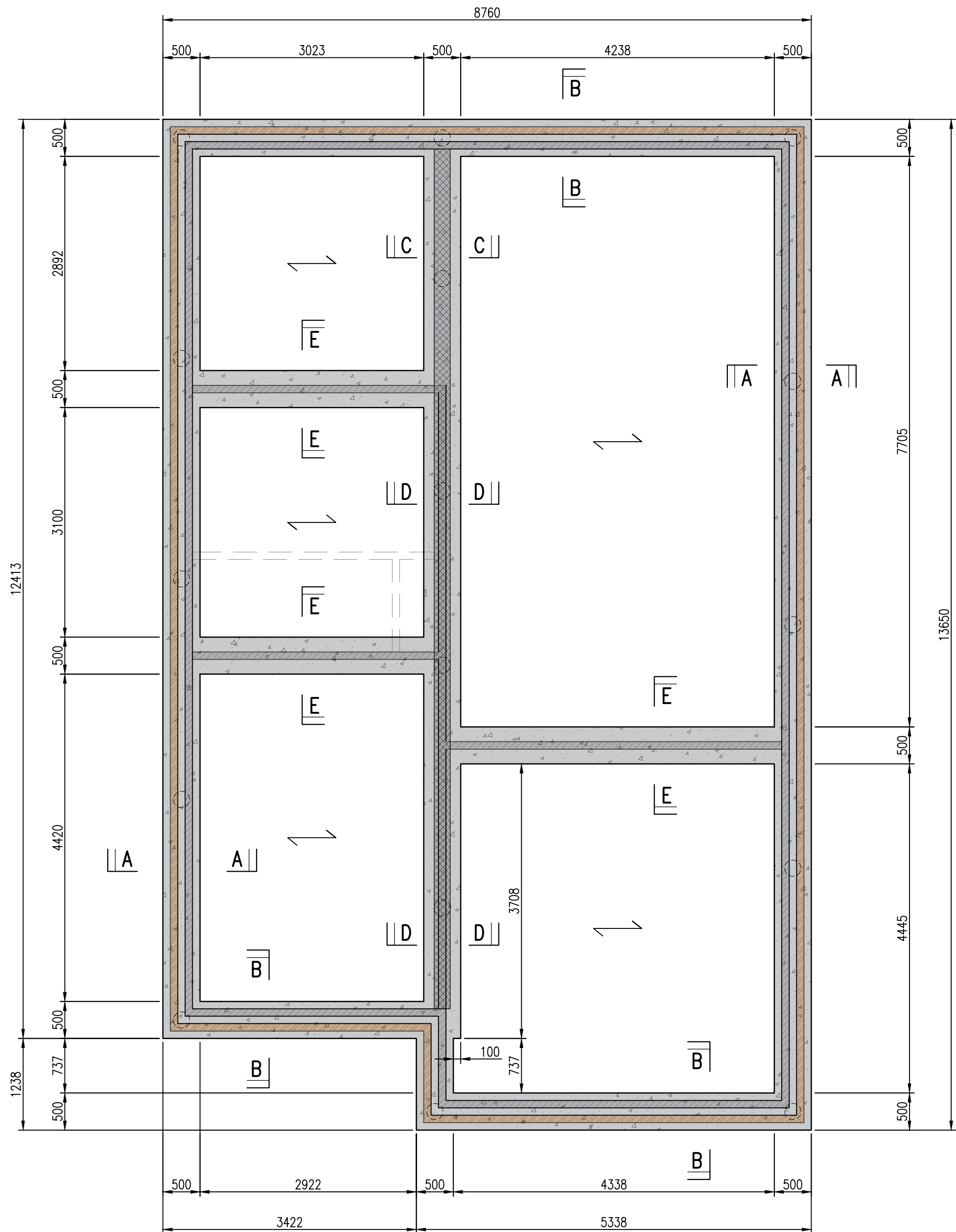
SHIELDS WILSON		e: info@shieldswilson.co.uk t: 01775 729252	
STRUCTURAL AND CIVIL ENGINEERING			
STATUS FOR INFORMATION			
CLIENT SCENIC HOMES DEVELOPMENTS LTD.			
PROJECT 5 PLOTS, ADJACENT 128 BARRIER BANK, COWBIT, SPALDING, Lincs.			
TITLE PLOT 5 PROPOSED PILING ARRANGEMENT & DETAILS			
DATE	OCT. '22	SCALE 0A1 1:50 1:20	DRAWING NO. SW 22-170-212
DRAWN	MRB		REV. —

PLEASE REFER TO ARCHITECTS DRAWINGS FOR
CONFIRMATION OF ALL WALL/SETTING OUT
DIMENSIONS PRIOR TO COMMENCING OF WORKS

THIS DRAWING MUST BE READ IN CONJUNCTION
WITH ALL RELEVANT DRAWINGS & STRUCTURAL
CALCULATIONS

GROUND BEAM SPECIFICATION

1. CONCRETE TO BE DS-2, DC-2, ACEC-2 TO BS 8500.
2. REINFORCED CONCRETE FOUNDATIONS TO BE MINIMUM GRADE C28/35 WITH A MINIMUM O.P.C. CONTENT OF 300 KG/m³ AND A WATER CEMENT RATIO OF 0.6. RC 28/35 TO BS 8500
3. COVER TO BE 75mm BTM, 50mm TOP & SIDES.
4. SHOULD SURFACE/GROUND WATER ENTER THE EXCAVATIONS PRIOR TO BLINDING WITH CONCRETE, THE BOTTOMS ARE TO BE REFORMED TO THE SATISFACTION OF THE ENGINEER.
5. REINFORCING BARS (GRADE 500B), AND MESH FABRIC TO BE HIGH YIELD BAR IN ACCORDANCE WITH BS 4461 AND BS 4483 RESPECTIVELY.
6. MINIMUM LAP TO REINFORCING BARS TO BE 40 TIMES BAR DIA.
7. MINIMUM LAP TO MESH FABRIC TO BE 350mm.
8. ALL REINFORCED CONCRETE TO BE COMPACTED USING AN IMMERSION VIBRATOR TO EXPELL TRAPPED AIR AND FORM A CONSISTENT DENSE MATERIAL.
9. NO CONCRETE TO BE POURED IF AMBIENT TEMPERATURE IS LESS THAN 5 DEGREES CENTIGRADE.



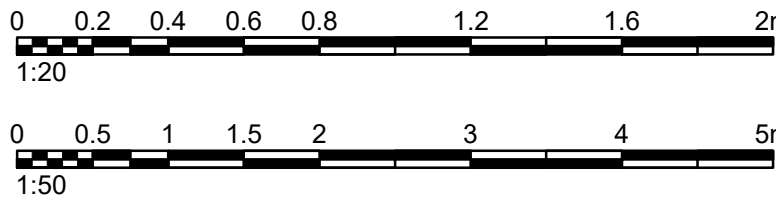
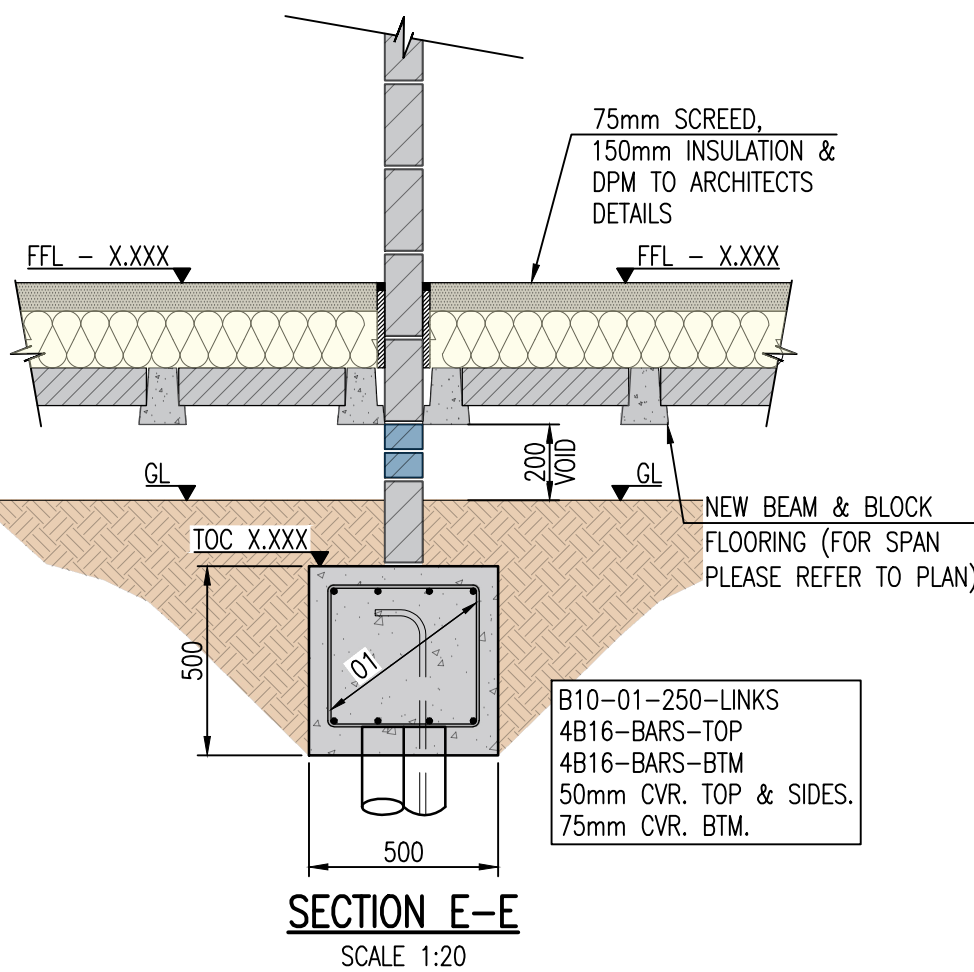
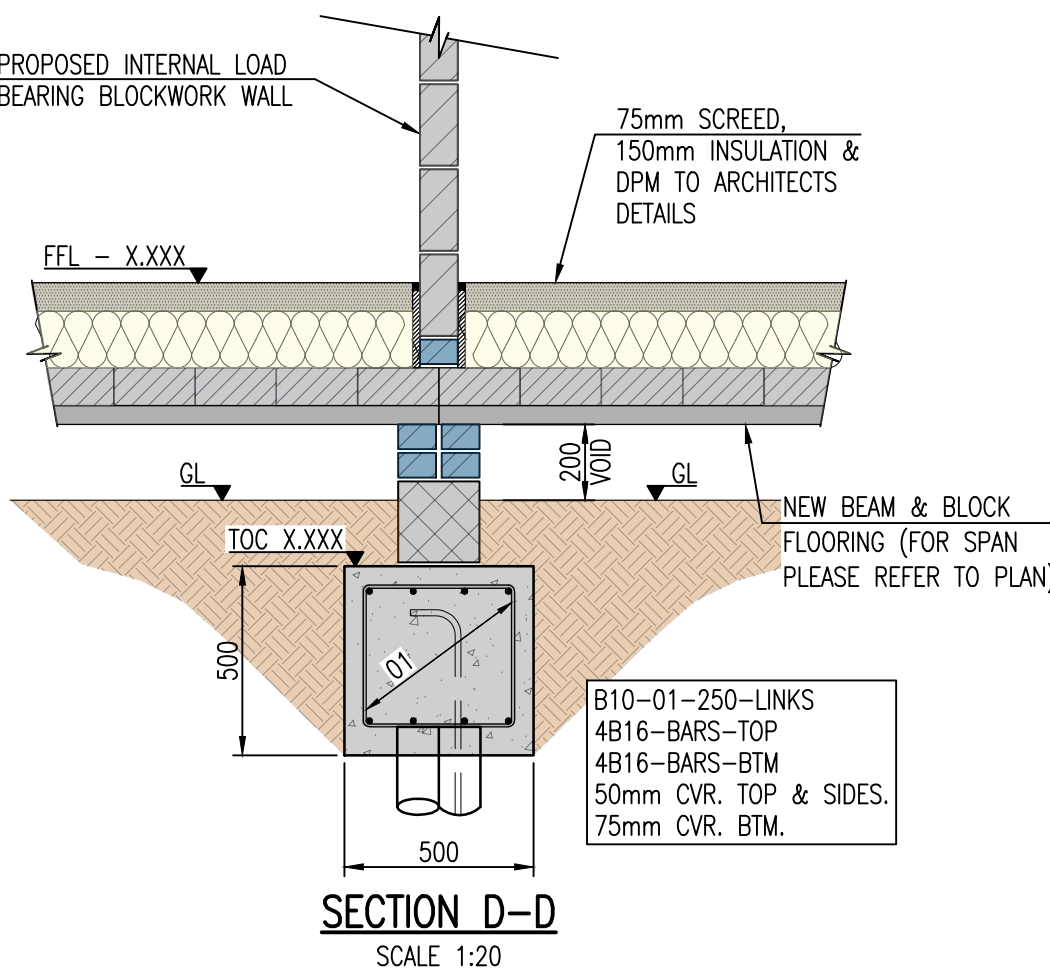
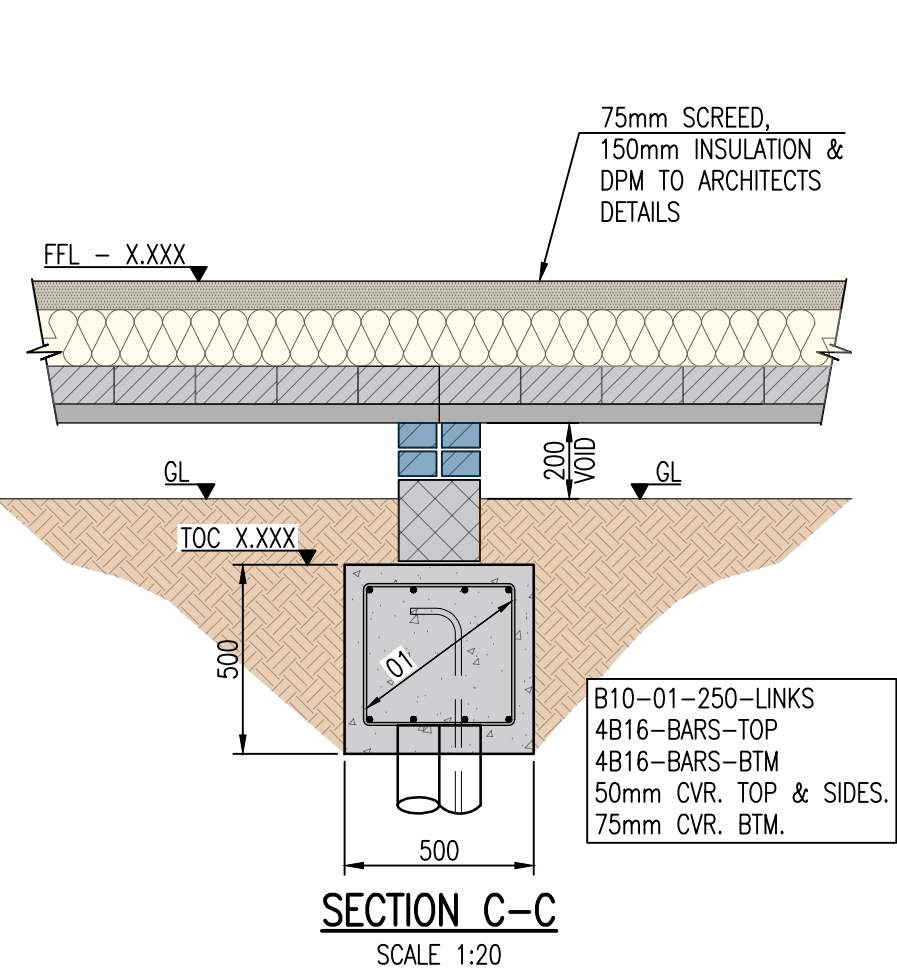
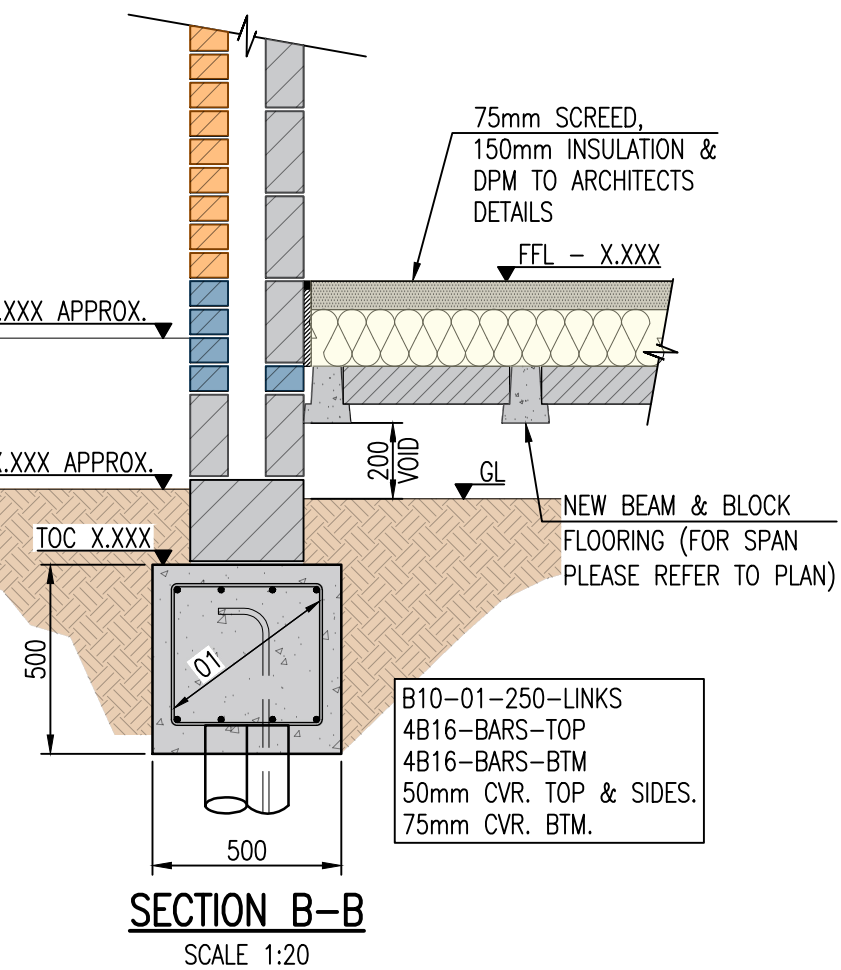
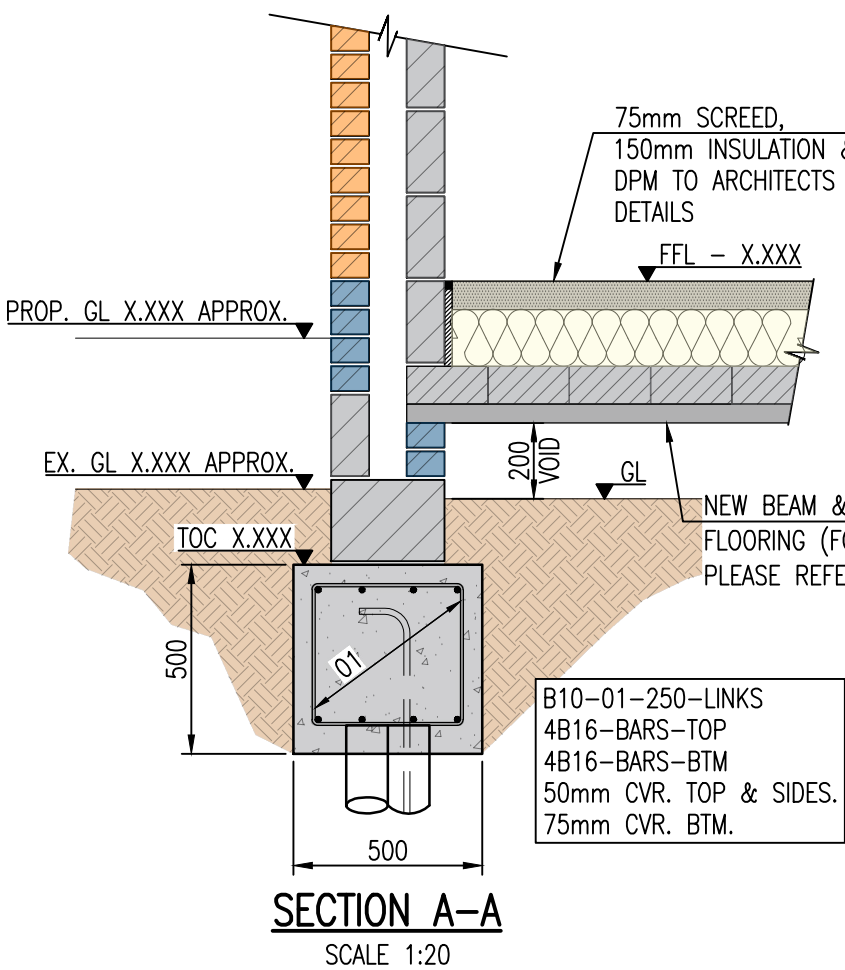
PROPOSED STRIP FOUNDATION ARRANGEMENT
PLOT 1
SCALE 1:50

Key:

- DENOTES OUTER LEAF MASONRY
- DENOTES INNER LEAF MASONRY
- DENOTES STUDWORK WALLS
- DENOTES 215 THK. SLEEPER WALL
- DENOTES SPAN OF GROUND FLOOR BEAM & BLOCK FLOORING DESIGNED BY MANUFACTURER

LOADINGS:

BEAM & BLOCK - S/W BY MANUFACTURER
IMPOSED - 1.5kN/m²
BLOCKWORK PARTITIONS - 5.0 kN/m LINE LOAD
FINISHES - 1.80kN/m²
GARAGE IMPOSED - 2.50kN/m²



REV.	DESCRIPTION	DRN.	APP.	DATE
-	PRELIMINARY - FOR APPROVAL	AS	APW	05.09.22

SHIELDS WILSON
e: info@shieldswilson.co.uk t: 01775 729262
STRUCTURAL AND CIVIL ENGINEERING

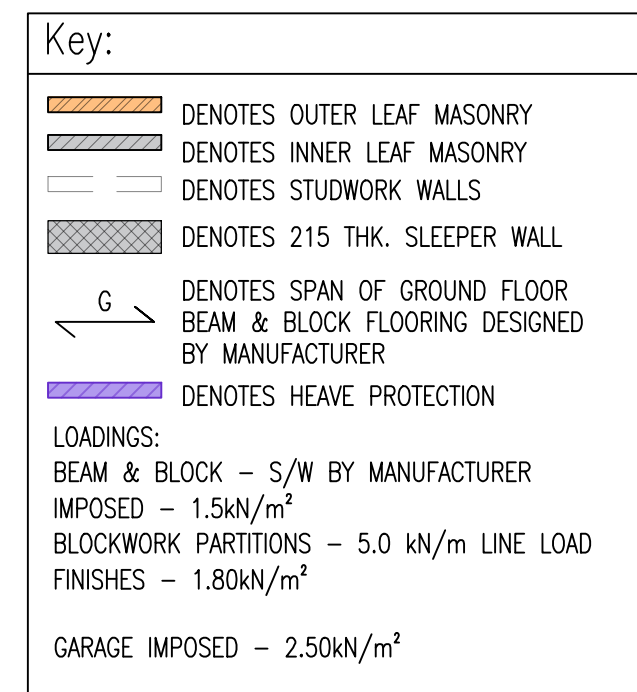
STATUS
FOR INFORMATION

CLIENT
SCENIC HOMES LTD.

PROJECT
5 PLOTS, ADJACENT 158 BARRIER BANK,
COWBIT, SPALDING, Lincs.
SPALDING, Lincs, PE12 0EJ

TITLE
PLOT 1
PROPOSED GROUND BEAM ARRANGEMENT
& DETAILS

DATE	SEPT. '22	SCALE 0A1 1:50	DRAWING NO. SW 22-170-201	REV.
DRAWN	AS	1:20		-



75mm SCREED, & DPM TO ARCHITECTS DETAILS

FFL - TBC

PROP. GL TBC APPROX.

EX. GL TBC APPROX.

200 VOID

GL

NEW BEAM & BLOCK FLOORING (FOR SPAN PLEASE REFER TO PLAN)

TOC TBC

500

500

50mm CLAYMASTER O.S.A HEAVE PROTECTION

175mm CLAYMASTER O.S.A HEAVE PROTECTION

B10-01-250-LINKS
4B12-BARS-TOP
4B12-BARS-BTM
50mm CVR. TOP & SIDES.
75mm CVR. BTM.

SECTION A-A
SCALE 1:20

75mm SCREED, & DPM TO ARCHITECTS DETAILS

FFL - TBC

PROP. GL TBC APPROX.

EX. GL TBC APPROX.

200 VOID

GL

NEW BEAM & BLOCK FLOORING (FOR SPAN PLEASE REFER TO PLAN)

TOC TBC

500

500

50mm CLAYMASTER O.S.A HEAVE PROTECTION

175mm CLAYMASTER O.S.A HEAVE PROTECTION

B10-01-250-LINKS
4B12-BARS-TOP
4B12-BARS-BTM
50mm CVR. TOP & SIDES.
75mm CVR. BTM.

SECTION B-B
SCALE 1:20

GARAGE FFL - TBC

GL

200 VOID

TOC TBC

500

500

50mm CLAYMASTER O.S.A HEAVE PROTECTION

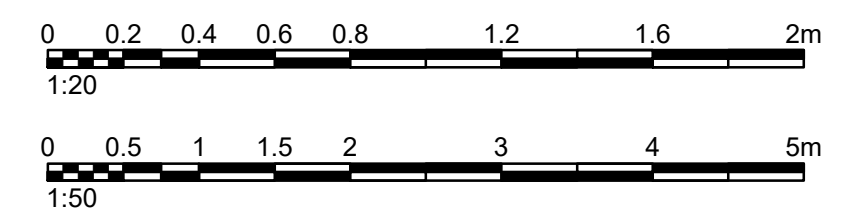
175mm CLAYMASTER O.S.A HEAVE PROTECTION

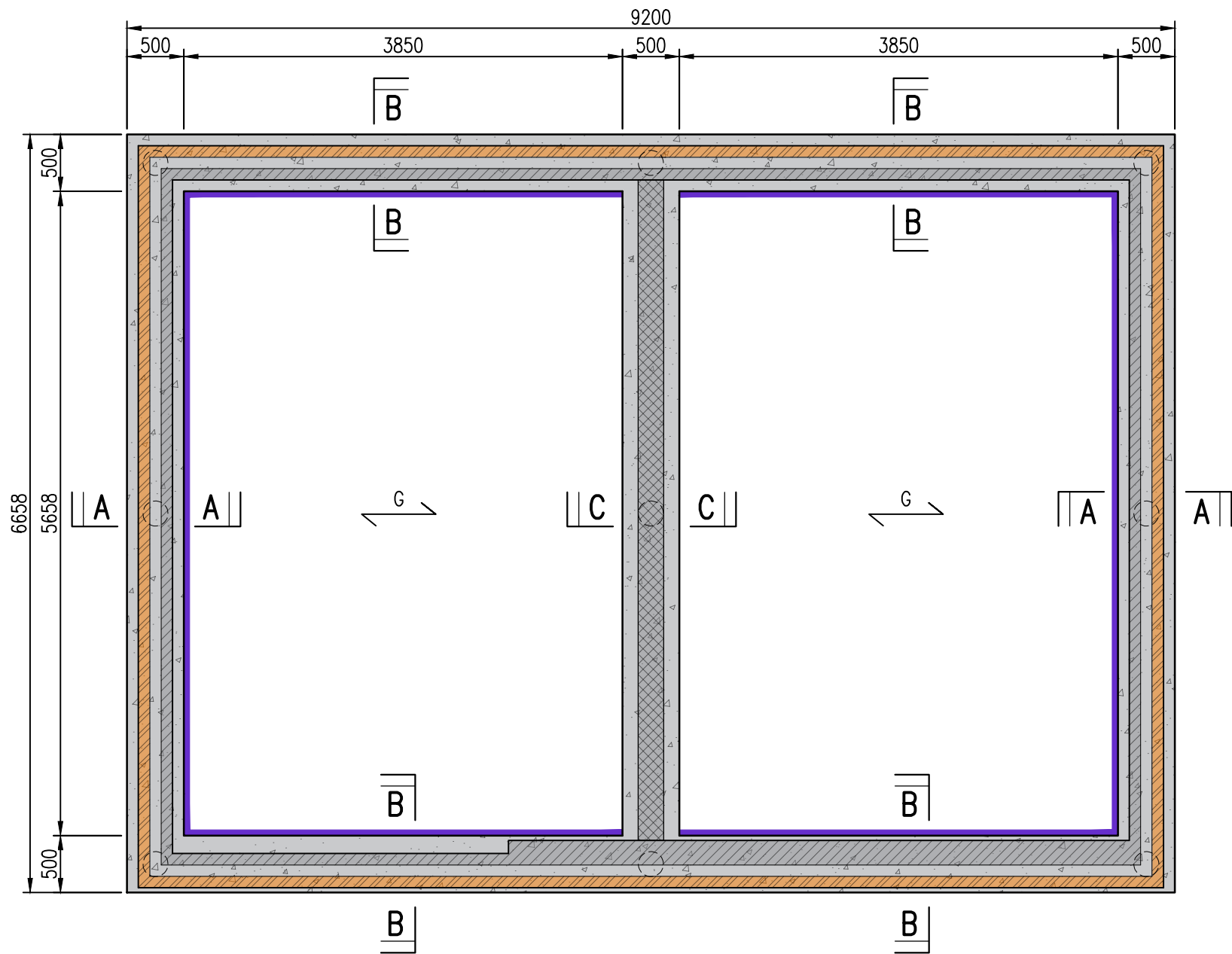
B10-01-250-LINKS
4B12-BARS-TOP
4B12-BARS-BTM
50mm CVR. TOP & SIDES.
75mm CVR. BTM.

SECTION C-C
SCALE 1:20

GROUNDREAM SPECIFICATION

1. CONCRETE TO BE DS-2, DC-2, ACEC-2 TO BS 8500.
2. REINFORCED CONCRETE FOUNDATIONS TO BE MINIMUM GRADE C28/35 WITH A MINIMUM O.P.C. CONTENT OF 300 KG/m³ AND A WATER CEMENT RATIO OF 0.6. RC 28/35 TO BS 8500
3. COVER TO BE 75mm BTM, 50mm TOP & SIDES.
4. SHOULD SURFACE/GROUND WATER ENTER THE EXCAVATIONS PRIOR TO BLINDING WITH CONCRETE, THE BOT TOMMS ARE TO BE REFORMED TO THE SATISFACTION OF THE ENGINEER.
5. REINFORCING BARS (GRADE 500B), AND MESH FABRIC TO BE HIGH YIELD BAR IN ACCORDANCE WITH BS 4461 AND BS 4483 RESPECTIVELY.
6. MINIMUM LAP TO REINFORCING BARS TO BE 40 TIMES BAR DIA.
7. MINIMUM LAP TO MESH FABRIC TO BE 350mm.
8. ALL REINFORCED CONCRETE TO BE COMPACTED USING AN IMMERSION VIBRATOR TO EXPELL TRAPPED AIR AND FORM A CONSISTENT DENSE MATERIAL.
9. NO CONCRETE TO BE POURED IF AMBIENT TEMPERATURE IS LESS THAN 5 DEGREES CENTIGRADE.



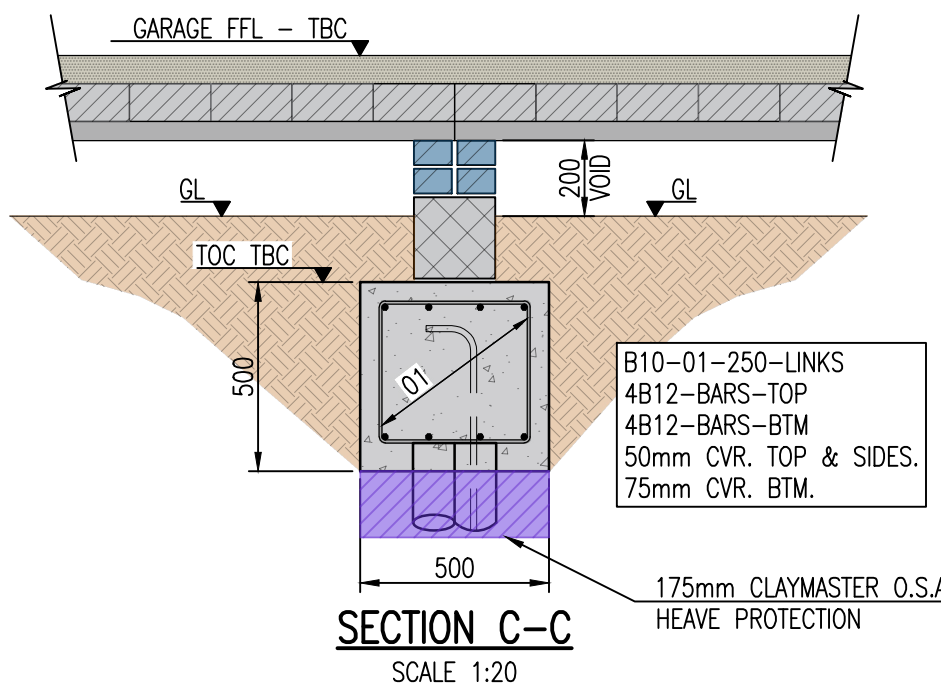
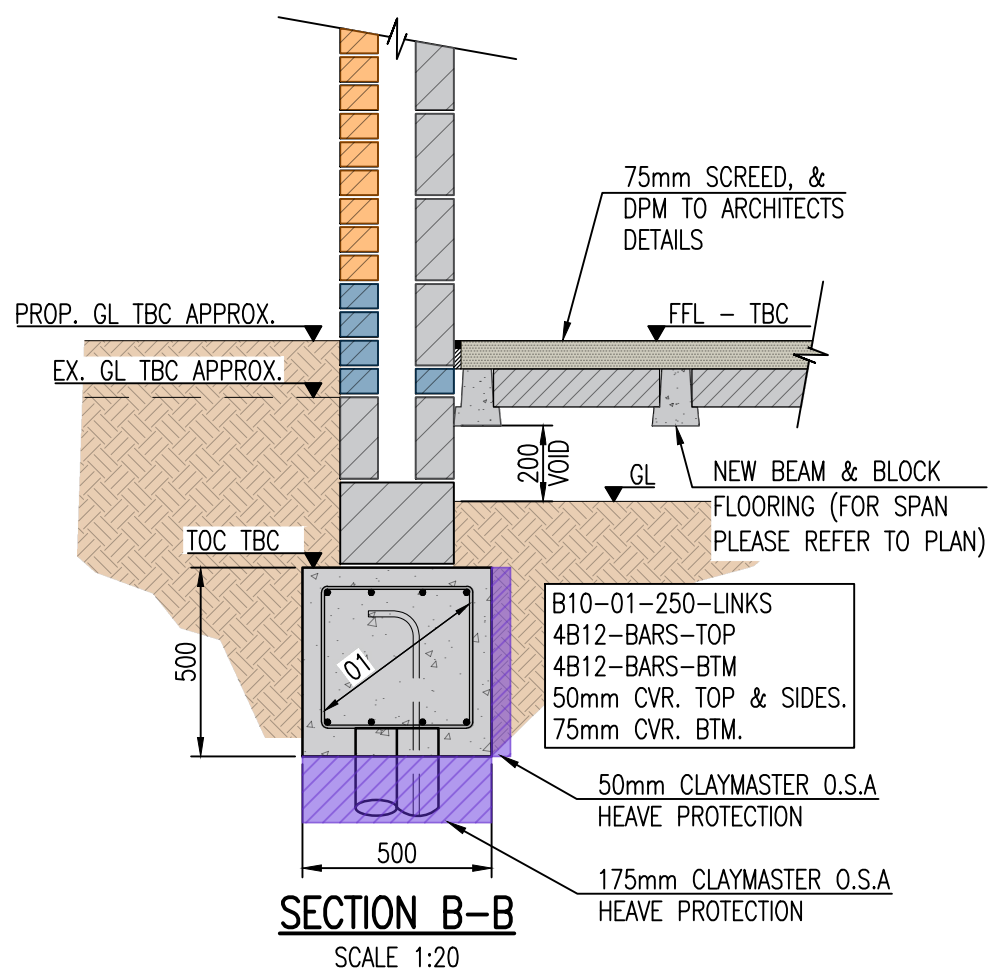
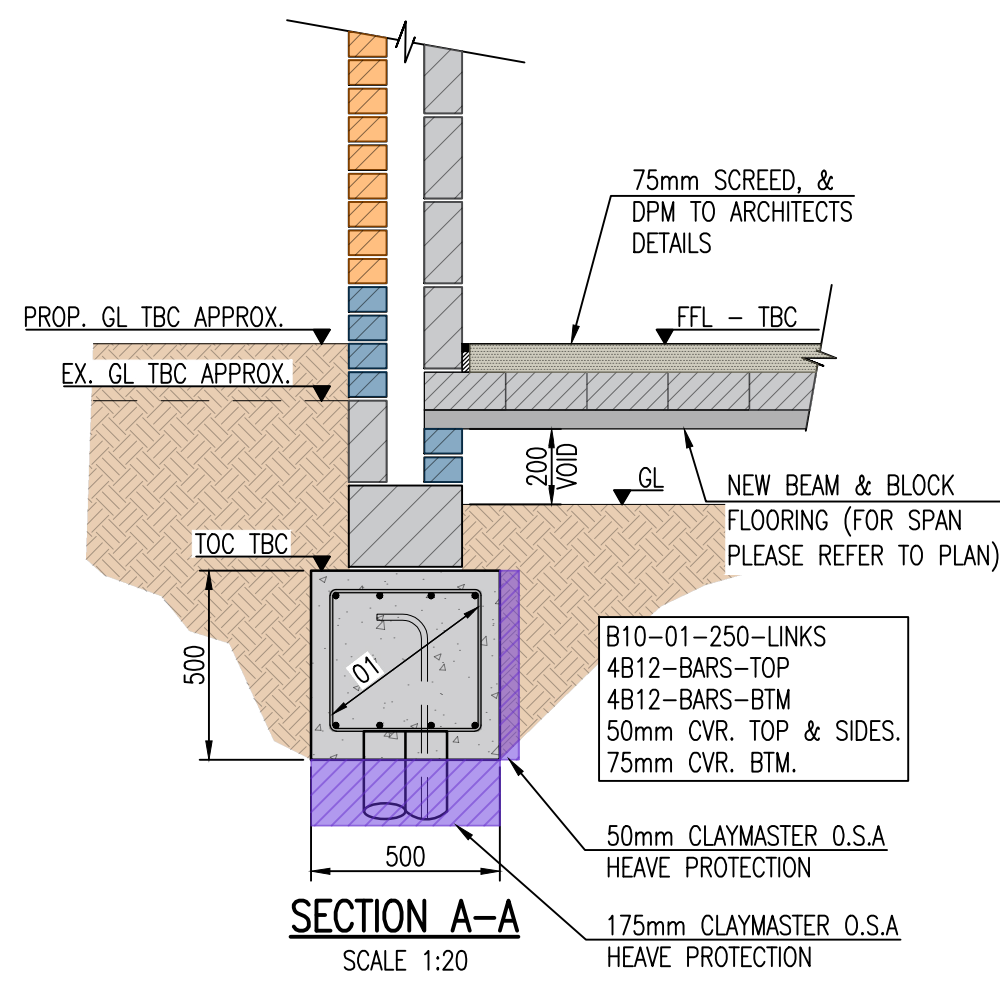


Key:

- DENOTES OUTER LEAF MASONRY
- DENOTES INNER LEAF MASONRY
- DENOTES STUDWORK WALLS
- DENOTES 215 THK. SLEEPER WALL
- DENOTES SPAN OF GROUND FLOOR BEAM & BLOCK FLOORING DESIGNED BY MANUFACTURER
- DENOTES HEAVE PROTECTION

LOADINGS:
BEAM & BLOCK – S/W BY MANUFACTURER
IMPOSED – 1.5kN/m²
BLOCKWORK PARTITIONS – 5.0 kN/m LINE LOAD
FINISHES – 1.80kN/m²
GARAGE IMPOSED – 2.50kN/m²

PROPOSED GROUNDBEAM FOUNDATION ARRANGEMENT
PLOT 3 GARAGE
SCALE 1:50

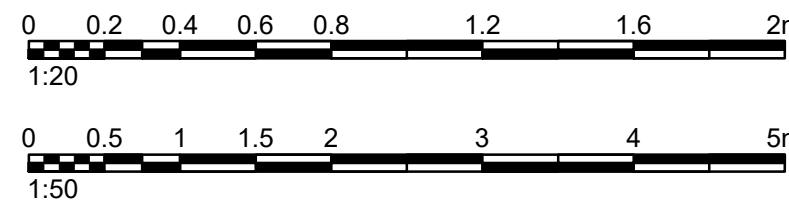


PLEASE REFER TO ARCHITECTS DRAWINGS FOR
CONFIRMATION OF ALL WALL/SETTING OUT
DIMENSIONS PRIOR TO COMMENCING OF WORKS

THIS DRAWING MUST BE READ IN CONJUNCTION
WITH ALL RELEVANT DRAWINGS & STRUCTURAL
CALCULATIONS

GROUNDBEAM SPECIFICATION

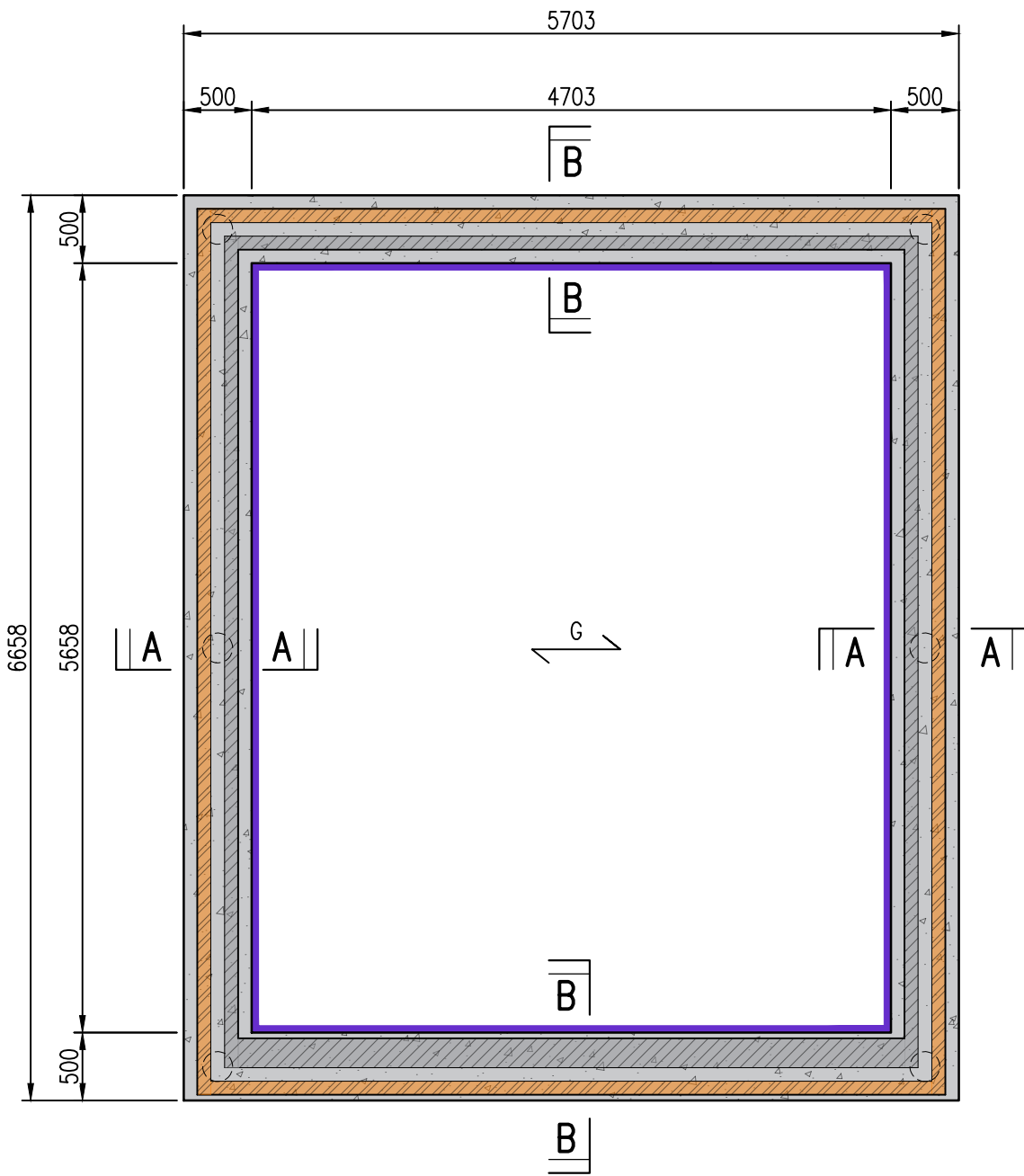
- CONCRETE TO BE DS-2, DC-2, ACEC-2 TO BS 8500.
- REINFORCED CONCRETE FOUNDATIONS TO BE MINIMUM GRADE C28/35 WITH A MINIMUM O.P.C. CONTENT OF 300 KG/m³ AND A WATER CEMENT RATIO OF 0.6. RC 28/35 TO BS 8500
- COVER TO BE 75mm BTM, 50mm TOP & SIDES.
- SHOULD SURFACE/GROUND WATER ENTER THE EXCAVATIONS PRIOR TO BLINDING WITH CONCRETE, THE THE BOTTOMS ARE TO BE REFORMED TO THE SATISFACTION OF THE ENGINEER.
- REINFORCING BARS (GRADE 500B), AND MESH FABRIC TO BE HIGH YIELD BAR IN ACCORDANCE WITH BS 4461 AND BS 4483 RESPECTIVELY.
- MINIMUM LAP TO REINFORCING BARS TO BE 40 TIMES BAR DIA.
- MINIMUM LAP TO MESH FABRIC TO BE 350mm.
- ALL REINFORCED CONCRETE TO BE COMPACTED USING AN IMMERSION VIBRATOR TO EXPELL TRAPPED AIR AND FORM A CONSISTENT DENSE MATERIAL.
- NO CONCRETE TO BE POURED IF AMBIENT TEMPERATURE IS LESS THAN 5 DEGREES CENTIGRADE.



—	PRELIMINARY – FOR APPROVAL				MRB JL 16.02.24
REV.	DESCRIPTION			DRN. APP.	DATE

SHIELDS WILSON
e: info@shieldswilson.co.uk t: 01775 729252
STRUCTURAL AND CIVIL ENGINEERING

STATUS	FOR INFORMATION				
CLIENT	SCENIC HOMES LTD.				
PROJECT	5 PLOTS ADJACENT 128 BARRIER BANK COWBIT, SPALDING, Lincs.				
TITLE	PLOT 3 GARAGE PROPOSED GROUNDBEAM ARRANGEMENT & DETAILS				
DATE	FEB. '24	SCALE 1:50	DRAWING NO.		REV.
DRAWN	MRB	1:20	SW22-170-222		—

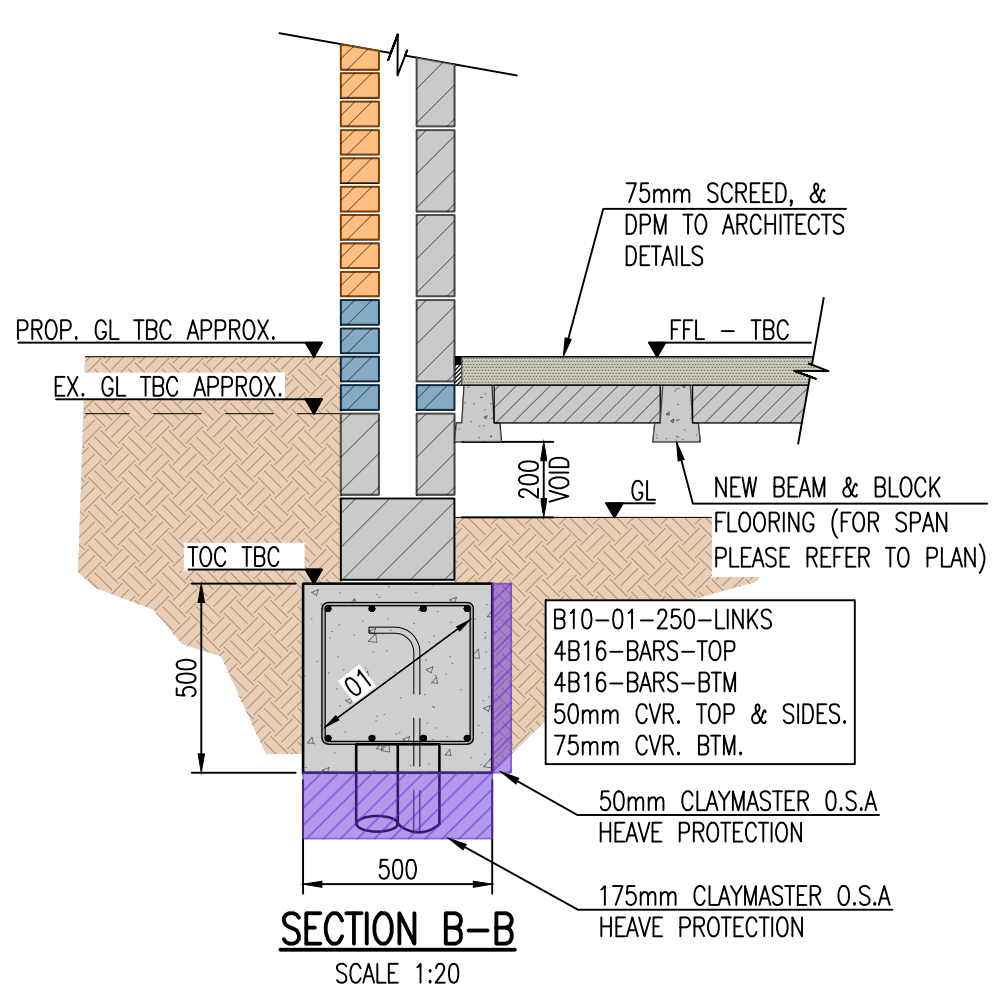
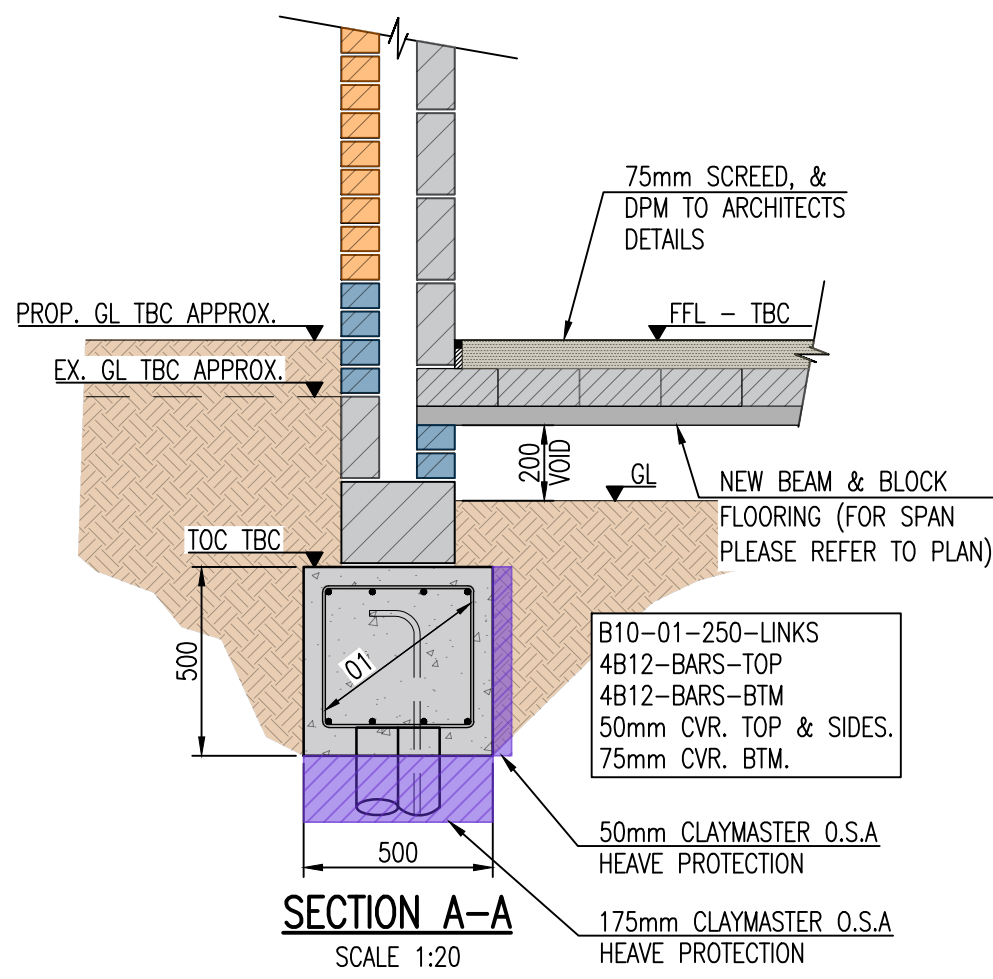


Key:

- DENOTES OUTER LEAF MASONRY
- DENOTES INNER LEAF MASONRY
- DENOTES STUDWORK WALLS
- DENOTES 215 THK. SLEEPER WALL
- DENOTES SPAN OF GROUND FLOOR BEAM & BLOCK FLOORING DESIGNED BY MANUFACTURER
- DENOTES HEAVE PROTECTION

LOADINGS:
BEAM & BLOCK – S/W BY MANUFACTURER
IMPOSED – 1.5kN/m²
BLOCKWORK PARTITIONS – 5.0 kN/m LINE LOAD
FINISHES – 1.80kN/m²
GARAGE IMPOSED – 2.50kN/m²

PROPOSED GROUNDBEAM FOUNDATION ARRANGEMENT
DOUBLE GARAGE
SCALE 1:50

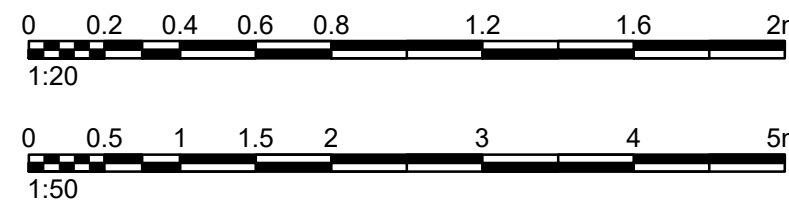


PLEASE REFER TO ARCHITECTS DRAWINGS FOR
CONFIRMATION OF ALL WALL/SETTING OUT
DIMENSIONS PRIOR TO COMMENCING OF WORKS

THIS DRAWING MUST BE READ IN CONJUNCTION
WITH ALL RELEVANT DRAWINGS & STRUCTURAL
CALCULATIONS

GROUNDBEAM SPECIFICATION

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—	PRELIMINARY – FOR APPROVAL				MRB JL 16.02.24
REV.	DESCRIPTION			DRN. APP. DATE	

SHIELDS WILSON
e: info@shieldswilson.co.uk t: 01775 729252
STRUCTURAL AND CIVIL ENGINEERING

STATUS
FOR INFORMATION

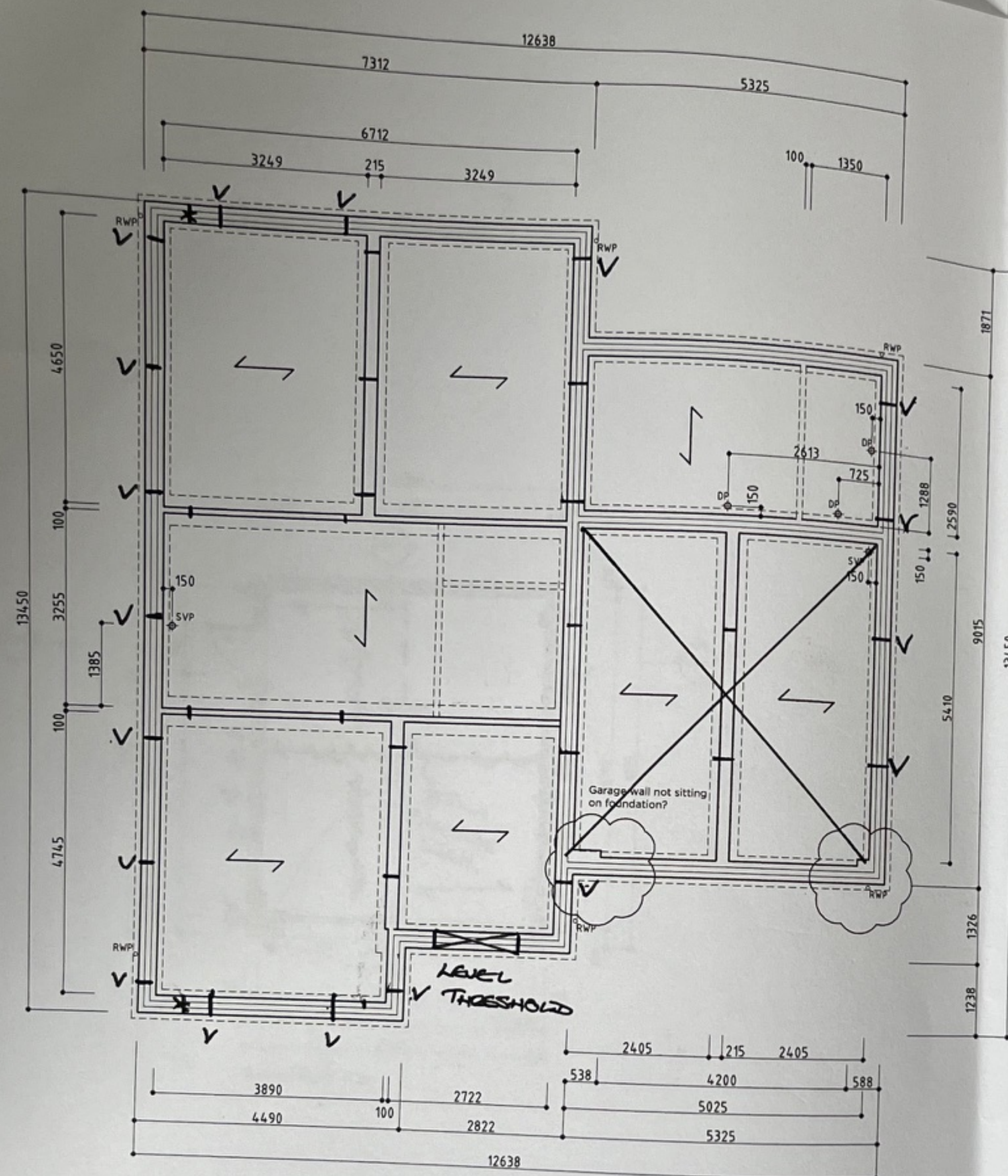
CLIENT
SCENIC HOMES LTD.

PROJECT
5 PLOTS ADJACENT 128 BARRIER BANK
COWBIT, SPALDING, Lincs.

TITLE
DOUBLE GARAGE
PROPOSED GROUNDBEAM ARRANGEMENT
& DETAILS

DATE	FEB. '24	SCALE 1:50	DRAWING NO.	REV.
DRAWN	MRB	1:20	SW22-170-216	—

Appendix B – Ventilation Markups



Substructure Plan
Plot 2

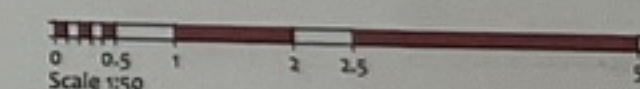
Direction of Precast Concrete Floor Beams
To be confirmed by Precast Concrete Beam &
Block Floor manufacturer



Building Regulations $78,264 \text{ mm}^2$
Actual (vert $6,450 \text{ mm}^2$) $116,100 \text{ mm}^2$
Extra Ventilation 48%.

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This drawing is copyright and may not be altered, traced, or
used for any purpose other than that for which it is issued
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The Contractor is to check all dimensions on site and report
discrepancies to the designer prior to commencing work.
All details shown on this drawing are based upon typical site
conditions. No responsibility can be accepted for abnormal
amendments unless reported to the designer, so that
amendments may be considered.
All works and materials used are to be in accordance with
current British Standards, Agreement Certificates and
Manufacturers instructions.
All Building Regulation inspections are to be carried out at the
required stages.

REVISION NOTES:



seven22
ARCHITECTURE LTD

22 SHORE VIEW, PETERBOROUGH
CAMBRIDGESHIRE, PE7 8FS
E.info@seven22.co.uk - T.07799 585277

PROJECT
RESIDENTIAL DEVELOPMENT
128 BARRIER BANK
COWBIT
SPALDING
LINCOLNSHIRE PE12 6AL

SH
SCENIC
HOMES

CLIENT
SCENIC HOMES

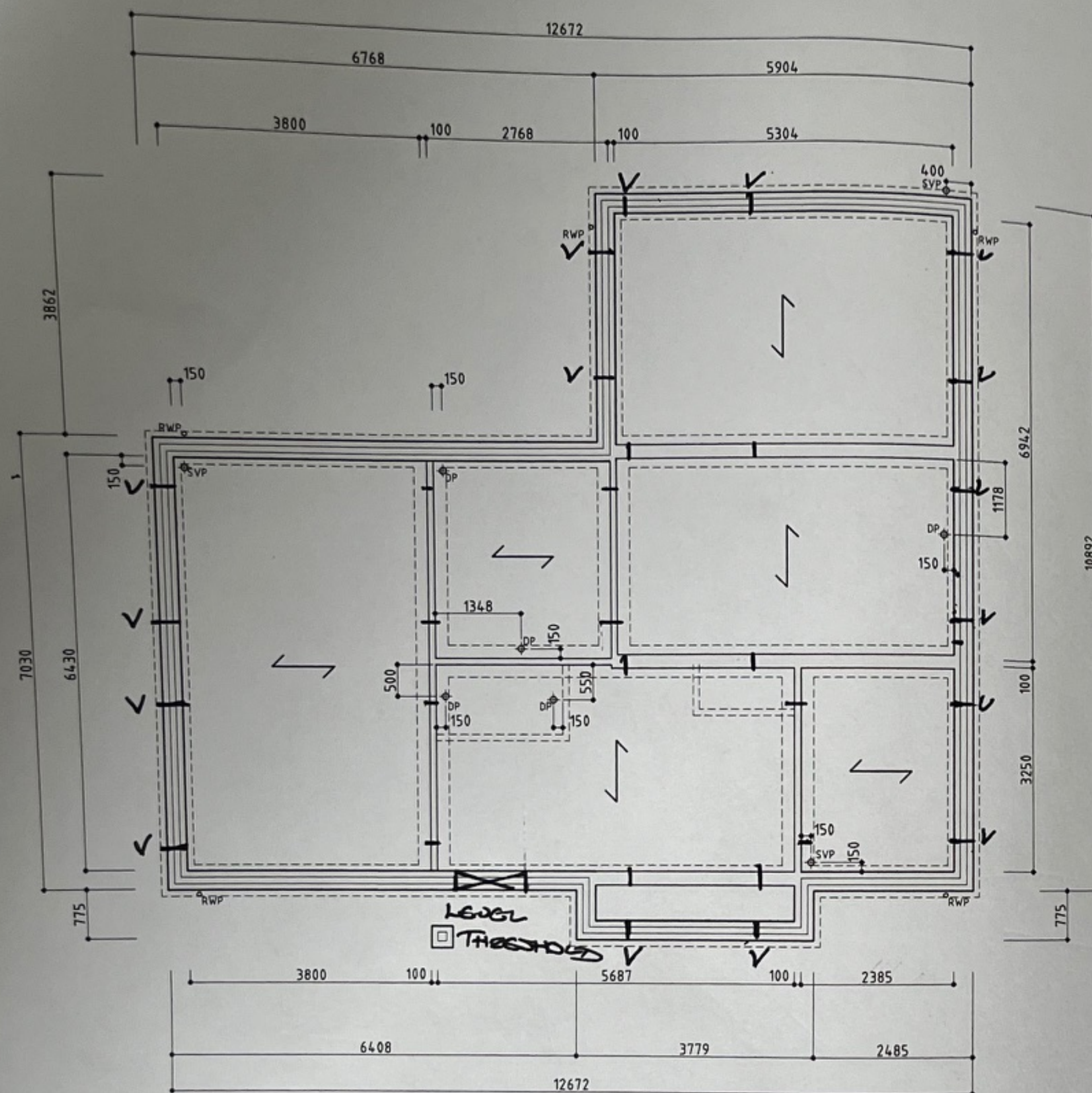
TITLE
PLOT 2
PROPOSED SUBSTRUCTURE PLAN

DRAWING No.
089 - Plot 2 - 04

SCALE
1:50 @ A1, 1:100 @ A3

DATE
JULY 24

REV



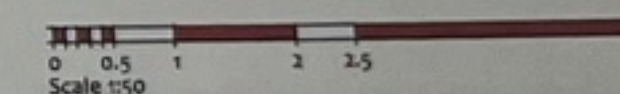
Substructure Plan
Plot 3

Building Regulations 73,017 m².
Actual (Vent 6450m²) 103,200 m²
Extra Ventilation 41%.

Do NOT scale from this drawing.
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REVISION NOTES:

Rev A 10/07/24-SVP LOCATIONS AMENDED.



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PROJECT
RESIDENTIAL DEVELOPMENT
128 BARRIER BANK
COWBIT
SPALDING
LINCOLNSHIRE PE12 6AL

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SCENIC
HOMES

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SCENIC HOMES

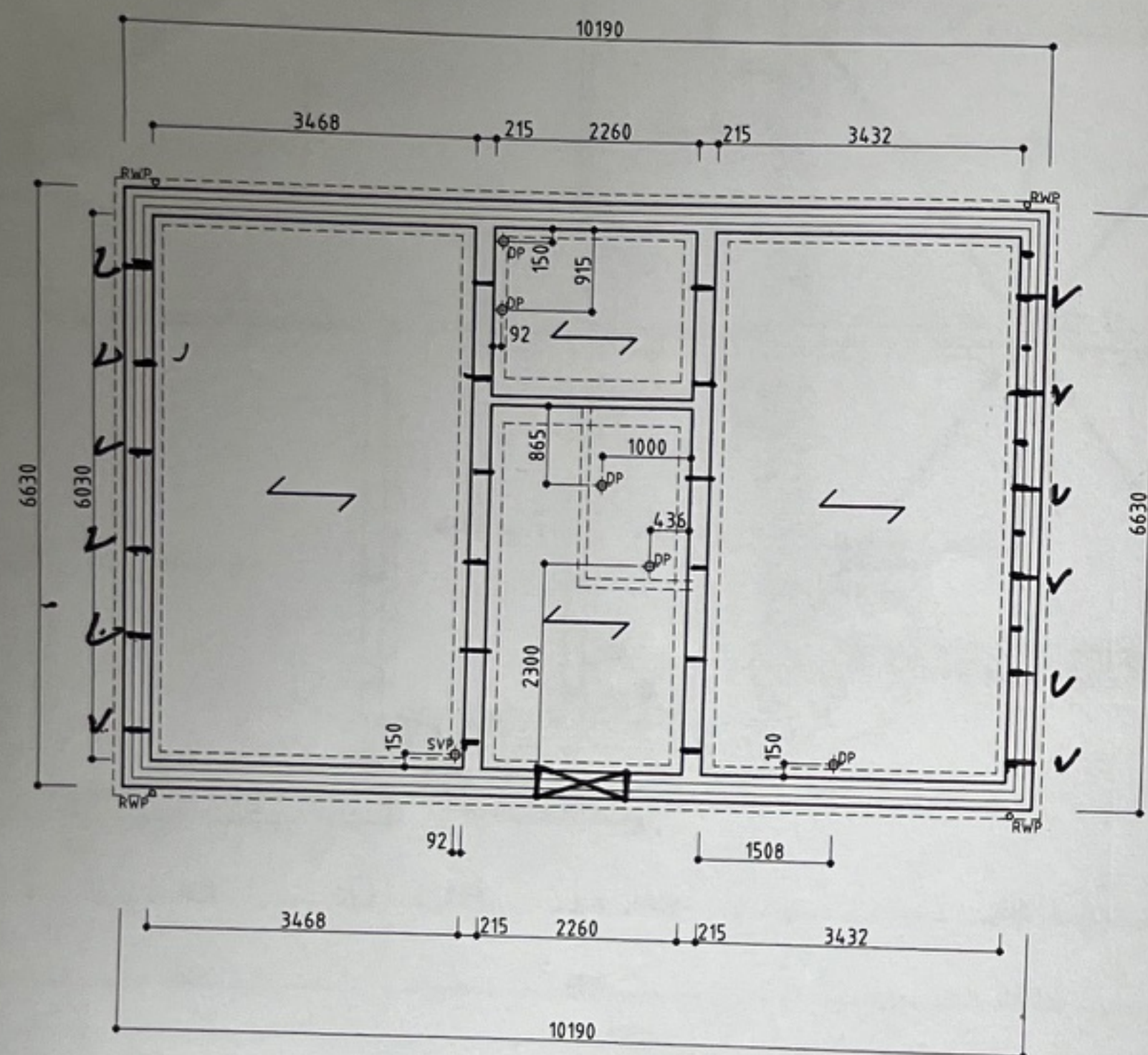
TITLE
PLOT 3
PROPOSED SUBSTRUCTURE PLAN

DRAWING NO.
089 - Plot 3 - 06

SCALE
1:50 @ A1, 1:100 @ A3

DATE
JULY 24

REV
A



Substructure Plan
Plot 5

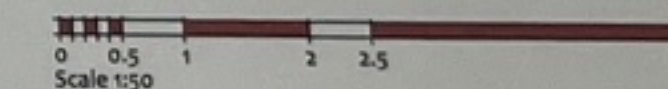
Direction of Precast Concrete Floor Beams
To be confirmed by Precast Concrete Beam &
Block Floor manufacturer



Building Regulations. 50,460mm²
Actual Vent 6,450mm² 77,400mm²
Extra Ventilation 53%.

Do NOT scale from this drawing.
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REVISION NOTES:



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PROJECT
RESIDENTIAL DEVELOPMENT
128 BARRIER BANK
COWBIT
SPALDING
LINCOLNSHIRE PE12 6AL

SH
SCENIC
HOMES

CLIENT
SCENIC HOMES

TITLE
PLOT 5
PROPOSED SUBSTRUCTURE PLAN

DRAWING No.
089 - Plot 5 - 06

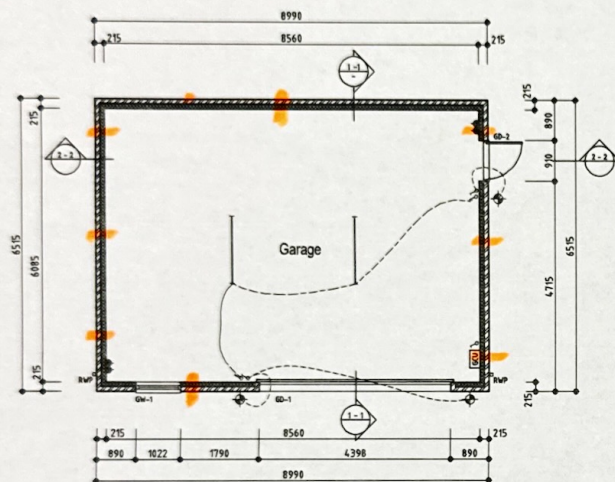
SCALE
1:50 @ A1, 1:100 @ A3

DATE
JULY 24

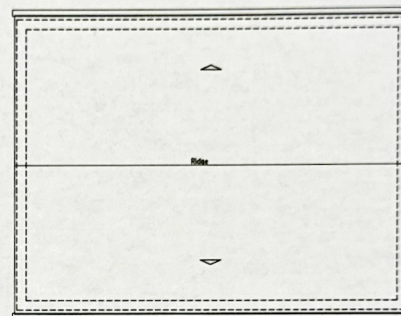
REV

$$Lm \ 31.01m \times 1,500m^2 = \underline{46,515m^2} \div 6,450m^2 = 7.2m^2 = 8 \text{ VENTS,}$$

$$A. \ 52.09m^2 \times 500m^2 = 26,045m^2$$



Ground Floor Plan



Roof Plan

NOTE:
SEVEN22 ARCHITECTURE DRAWINGS PROVIDED TO AID SETTING OUT & LAYOUT PURPOSES ONLY. CROSS REFER TO INFORMATION PROVIDED BY WILSON BUILDERS LTD & REINWAY DESIGN LTD, AS WELL AS THEIR CONSTRUCTION NOTES. SEVEN22 ARCHITECTURE ACCEPT NO RESPONSIBILITY FOR ISSUES OF COMPLIANCE RELATING TO THE DESIGN OR CONSTRUCTION SPECIFICATIONS.

ALL MEASUREMENTS TO BE CONFIRMED ON SITE PRIOR TO MANUFACTURE. REFER TO LINTEL SUPPLIER/MANUFACTURER SCHEDULES.

DOORS

NUMBER	LOCATION	STRUCT. OPENING	LINTEL REF	LINTEL LENGTH	REMARKS
GD1	GARAGE DOOR	4398x2254mm			
GD2	PERGOLA DOOR	910x780mm			

WINDOWS

NUMBER	LOCATION	STRUCT. OPENING	LINTEL REF	LINTEL LENGTH	REMARKS
GW-1	GARAGE	1802.5x1954mm			

NOTE:
ALL BEDROOM WINDOW OPENING VENTS TO ALLOW MEANS OF ESCAPE IN AN EMERGENCY SITUATION. OPENING VENT ALL LEVEL TO BE WITHIN 800mm & 1000mm OF FFL & min. 650 WIDE IN EACH DIRECTION WITH AN AREA OF 0.33m² & FITTED WITH EGRESS FRAMES.

- CONSUMER UNIT
- GARAGE CONSUMER UNIT
- THERMOSTAT
- UPH MANIFOLD
- ELECTRIC METER
- PROGRAMMER
- INVERSION HEATER
- HEATED TOWEL RAIL POSITION
- RADIATOR POSITION
- RAINHEAD SHOWER w/ BAR SHOWER OVER BATH
- EXTERNAL TAP LOCATION

NOTE:
ALL PROPERTIES ARE CONNECTED TO
OPEN-LEACH SUPPLY/FAST FIBRE BROADBAND

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All Building Regulation inspections are to be carried out at the required stages.

REVISION NOTES

Rev A (10/11/14) - Garage external wall thickness amended

- SIMPLE 1st FLOOR
- SIMPLE 2nd FLOOR
- EXTERNAL DOUBLE 1st FLOOR
- SIMPLE 1st FLOOR HIGH LEVEL ABOVE WHORLTOP
- SWITCHED PIPED SPOUT 115 Wc, APPLIANCES C.A. Wm Dm 115
- CORNER POINT
- CORNER HINGE
- HBB CONTROLS
- EXTRACTOR FAN POWER SUPPLY
- MEDIA PANEL
- MASTER BT POINT
- LIGHT SWITCH
- 2-WAY SWITCH
- 3-WAY SWITCH
- PENDANT LIGHT FITTING
- RECESSED DOWNLIGHT
- EXTERNAL PIR FLOOD LIGHT
- EXTERNAL PIR WALL LIGHT UP & DOWN LIGHTS
- EXTRACT FAN CEILING MOUNTED TO TILE VENTS
- EXTRACT FAN & LIGHT CEILING MOUNTED TO TILE VENTS
- EXTRACT FAN ISOLATOR CUPBOARD, WALL MOUNTED HIGH LEVEL ABOVE LIGHT SWITCH
- MIRROR WITH LIGHT & SHAVES SOCKET
- BATTEN LIGHT
- HEAT DETECTOR
- SMOKE DETECTOR

Scale 1:50
Scale 1:50

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ARCHITECTURE LTD

22 SHORE VIEW, PETERBOROUGH
CAMBRIDGESHIRE, PE7 8FS
E: info@seven22.co.uk - T: 07799 585277

PROJECT:
RESIDENTIAL DEVELOPMENT
128 BARRIER BANK
COWBIT
SPALDING
LINCOLNSHIRE PE12 6AL

SCENIC HOMES

CLIENT:
SCENIC HOMES

TITLE:
PLOT 3
PROPOSED GARAGE PLANS

DRAWING NO.
QB9 - Plot 3 - 04

SCALE: 1:50 @ A1, 1:100 @ A3 DATE: JUNE 24, 2024

Appendix C – Gas Membrane Data Sheets



GP® DPC

GP® DPC - Gas Resistant DPC is a unique single layer, embossed High Performance DPC. GP® DPC is specifically designed and manufactured to perform as a methane, carbon dioxide, radon and moisture resistant damp proof course.

TITANTECH®

For developers of brownfield and contaminated sites the TITANTECH® family of products represent a major step forward in safeguarding projects against gaseous and chemical contamination.

GP® DPC complies with the latest codes of practice as published by BRE, CIRIA and BSI (BS EN 14909 and BS8485:2015). Suitable for use as a High Performance DPC for vertical and horizontal applications. Superior adhesion to mortar is essential for buildings of 3+ storey height.

GP® DPC has an embossed surface to create superior mortar adhesion which is essential when being used in 3+ storey applications. JUTA GP® DPC is compliant to BS EN 14909:2012 and can be used in both vertical and horizontal applications.

Handling

Roll weights can be in excess of 5 kg and hence appropriate care and equipment is required for unloading and handling.

Thickness	0.8 mm
Width	100-1200 m
Length	20 m
Weight	730 g/m ²

Named Accessory in Certification



Please
Scan



Rev 2024



Feature	Characteristics	Test Method	GP® RADON DPC
Physical Properties	Thickness	EN 1849-2	0.8 mm
	Width	EN 1849-2	100-1200 m
	Length	EN 1849-2	20 m
	Weight	EN 1849-2	730 g/m ²
Hydraulic Properties	Water Vapour Permeation	EN 1931	0.09 g/m ² /day
	Resistance to Water Penetration	EN 1928	Pass
Mechanical Properties	Resistance to Static Load	EN 12730 - B	20 kg
	Tensile Strength (MD)	EN 12311-1	24 N/mm ²
	Tensile Strength (CMD)	EN 12311-1	22 N/mm ²
	Tensile Elongation (MD)	EN 12311-1	398%
	Tensile Elongation (CMD)	EN 12311-1	446%
	Resistance to Impact	EN 12691	660 mm
	Resistance to Tearing (Nail Shank) MD	EN 12310-1	700 N
	Resistance to Tearing (Nail Shank) CMD	EN 12310-1	750 N
Durability and Chemical Resistance	Joint Strength	EN 12317-1	520 N
	Heat Ageing	EN 1926	Pass
	Chemical Resistance	EN 1847	Pass
	Resistance to Fire	EN 13501-1	Class F
Gas Permeability	Resistance to Low Temperature	EN 495-5	Pass @ -40°C
	Radon Permeability	K124/02/95	9.5x10 ⁻¹² /m ² /s
Compliance and Certification	Methane Permeability	BS EN ISO 15105-1	33.9ml/m ² /day/atm
	CE Mark - EN13967:2012		
	NHBC Standards Compliant		
	BS EN 14909:2012 Compliant		
	BS 8485:2015 Compliant		

Feature	Pre-Compression (N/mm ²)	Characteristic Shear Strength (N/mm ²)
Characteristic Shear Strength	0.2	0.14
	0.6	0.34
	1.0	0.52

JUTA UK

For additional information or assistance, please contact JUTA UK directly.

Storage

Rolls of JUTA GP® DPC should be stored on stable/level ground and stacked not more than five rolls high, with no other material stacked on top. The rolls can be stored outdoors when packaged but should be protected from exposure to UV. JUTA GP® DPC is classified as non-hazardous and is chemically inert such that it will not react with any acid or alkali environment in which it is used.





Installation

GP® DPC must be installed in accordance with the guidelines laid out in BS8215:1991, BS8000: part 3 and BS 5628. It can be used in most common floor constructions and is installed in a similar manor to damp proof membrane. For external walls the DPC should be applied 150mm above the adjoining surface and should be linked to a DPM or Gas Resistant DPM in solid floors. The DPC should be applied to a fresh bed of mortar, completely free of projections that may puncture the material or impede the DPC from lying flat.

JUTA UK

For additional information or assistance, please contact JUTA UK directly.

Joining and Sealing

Sheets of GP® DPC must be clean, dry and free from dirt and grease before application of joining tape. JUTA GP® DPC may also be heat welded to the underlying Gas resistant membrane.

Accessory Products

JUTA GP® DPC is an accessory product for use in combination with GP® 1, GP® 2, GP®H, GP®SAM and GP® TITANTECH gas protective membranes. It is also compatible with a range of DPM and other DPC materials.



GP®5+

GP®5+ gas barrier is a multi-layer composite of virgin polyethylene (PE) giving exceptional resistance to the passage of ground gas and organic vapours. It also acts as a high performance DPM.

Thickness	0.5 mm
Width	Various m
Length	Various m
Weight	500 g/m ²

TITANTECH®

For developers of brownfield and contaminated sites the TITANTECH® family of products represent a major step forward in safeguarding projects against gaseous and chemical contamination.

GP®5+ is suitable for the following applications:

- Carbon dioxide and methane affected sites in accordance with BS 8485:2015 + A1:2019 & NHBC
- Radon affected sites in accordance with BRE211:2015
- Damp protection in accordance with Building Regulations Part C
- Low level VOC contaminated sites (site specific assessment required)
- Suitable for use on CS2-CS6 sites, and as a class A/B/C membrane to NF94

Installation

GP®5+ should be installed in accordance with the product installation guidelines, and in accordance with BS 8485:2015.





Feature	Characteristics	Test Method	GP [®] 5+
Physical Properties	Thickness	EN 1849-2	0.5 mm
	Width	EN 1849-2	Various m
	Length	EN 1849-2	Various m
	Weight	EN 1849-2	500 g/m ²
Hydraulic Press	Resistance to Water Penetration	EN 1928 (A)	Pass
Mechanical Properties	Resistance to Static Load	EN 12730	> 20 kg
	Tensile Strength (MD)	EN 12311-2 (A)	> 300 N/50mm
	Tensile Strength (CMD)	EN 12311-2 (A)	> 300 N/50mm
	Resistance to Tearing (Nail Shank) MD	EN 12310-1	> 230 N
	Resistance to Tearing (Nail Shank) CMD	EN 12310-1	> 230 N
	Impact Resistance	EN 12691-B	500 mm
	Puncture Resistance	ASTM D 4833	> 160 N
	Puncture Resistance	EN 12236	1.60 kN
	Reaction to Fire	EN 13501-1	E
Vapour Permeability	Methane Permeability	BS EN ISO 15105-1	0.12 ml/m ² /day/atm
	Carbon Dioxide Permeability	BS EN ISO 15105-1	1.53 ml/m ² /day/atm
	Hydrogen Permeability	BS EN ISO 15105-1	68.7 ml/m ² /day/atm
	Benzene Permeability	BS EN ISO 15105-2	0.41 ml/m ² /day
	Oxygen Permeability	BS EN ISO 15105-2	<3 ml/m ² /day
	Radon Permeability	K124/02/95	1.0 x 10 ⁻¹² m ² /s
Fuel Vapour Permeability	Petrol	BS EN ISO 15105-2	(ave.) 3.4 x 10 ⁻¹³ /mol/(m ² .s.Pa)
	Diesel	BS EN ISO 15105-2	(ave.) 3.4 x 10 ⁻¹³ /mol/(m ² .s.Pa)
Durability	Durability Watertightness After Artificial Ageing	EN 1928	Pass
	Durability Watertightness Against Chemicals	EN 1928	Pass
Compliance and Certification	CE Mark - EN 13967:2012		
	NHBC Standards Compliant		
	BS 8485:2015 + A1 2019 Accordant		

JUTA UK

Please contact JUTA
UK Directly for more
information on GP[®]5+

Handling

Roll weights can be in excess of 20kg and hence appropriate care and equipment is required for unloading and handling.

Storage

Rolls of GP[®]5+ should be stored on stable/level ground and stacked not more than five rolls high, with no other material stacked on top. The rolls can be stored outdoors when packaged, but should be protected from exposure to UV.



JUTA UK

Please contact JUTA
UK Directly for more
information on GP®5+

Jointing and Sealing

It is recommended GP®5+ can be heat welded where possible, with welding carried out by competent personnel with suitable qualifications in accordance with best practice, and guidance contained within BS 8485:2015. GP®5+ should be overlapped by at least 100mm. If taping joints, only suitable tape must be used, ensuring application with a silicone roller to remove trapped air. JUTA pre-formed details, or self adhesive gas membrane are available for sealing around protuberances.

Accessory Products

- GP® DPC
- GP® Tape
- GP® Self Adhesive Membrane (SAM)
- GP® Primer
- GP® Top Hats and Preformed Corners
- GP® Protection Fleece
- GP® Void Vent (24/40mm)



GP[®]1 SAM

GP[®]1 SAM, gas protection self adhesive membrane, is a bituminous gas proof and water proof sheet, composed of self-adhesive SBS polymer modified bitumen incorporating GP[®]1 with an upper surface finish of black reinforced LDPE, and a lower surface finish of siliconized release film. GP[®]1 SAM is used for the gas/waterproofing of underground structures where harmful ground gasses are anticipated, and as a self adhesive accessory to GP[®]1.

Thickness	1.2 mm
Width	0.9 m or 0.3 m
Length	20 m
Weight	1100 g/m ²

TITANTECH[®]

For developers of brownfield and contaminated sites the TITANTECH[®] family of products represent a major step forward in safeguarding projects against gaseous and chemical contamination.

Handling

Roll weights can be in excess of 20 kg (approx 33 kg/roll) and hence appropriate care and equipment is required for unloading and handling. This product is non-toxic nor flammable.

Storage

Rolls of GP[®]1 SAM should be stored on in a cool, dry place, and be protected from exposure to rain, sun, heat and cold temperatures prior to installation. Exposure to sunlight for extended period of time could cause difficulty with removal of the release film.





Feature	Characteristics	Test Method	GP [®] 1 SAM
Physical Properties	Thickness	EN 1849-2	1.2 mm
	Width	EN 1849-2	0.9 or 0.3 m
	Length	EN 1849-2	20 m
	Weight	EN 1849-2	1100 g/m ²
Hydraulic Press	Water Tightness	EN 1928	Pass
	Water Vapour Transmission	EN 1931	0.013 g/m ² /day
Mechanical Properties	Tensile Strength (MD/CMD)	EN 12311-2 (A)	500 N/50mm
	Elongation (MD/CMD)	EN 12311-2 (A)	> 12 %
	Resistance to Static Load	EN 12370	20 kg
	Joint Strength	EN 12317-2	> 30 N
	Durability and Water Tightness (Ageing and Chemicals) 60 kPa	EN 1847	Pass
	Resistance to Nail Tear (MD/CMD)	EN 12310-1	> 300 N
	Resistance to Fire	EN 13501	F Euro Class
Gas Permeability	Methane Permeability	EN ISO 15105-1	< 0.68 ml/m ² /day/atm
	Carbon Dioxide Permeability	EN ISO 15105-1	< 2.81 ml/m ² /day/atm
	Radon Permeability	K124/02/95	8.0 x 10 ⁻¹⁵ m ² /S
Compliance and Certification	CE Mark - EN13967:2012 + A1:2017 Type (A/T)		
	BS 8485:2015 Compliant (Methane and Carbon Dioxide Barrier)		

JUTA UK

Please contact JUTA UK Directly for more information on GP[®]1 SAM

Installation

GP[®]1 SAM should be installed in accordance with the product installation guidelines, and in accordance with BS 8485:2015, and/or BS 8102:2009.

It is recommended that GP[®]1 SAM is not applied in temperatures below 10°C, in colder weather the material can be warmed slightly to aid adhesion.

Accessory Products

- GP[®] Primer
- GP[®] Protection Board
- GP[®] Protection Fleece



GP[®]1 SAM

Installation Guidance

GP[®]1 SAM, gas resistant self adhesive membrane, is a bituminous gas proof and water proof sheet, composed of self-adhesive SBS polymer modified bitumen coated GP[®]1, and a lower surface finish or siliconized polypropylene release film. GP[®]1 SAM is used for the gas/waterproofing of underground structures where harmful ground gasses are anticipated, or as a self-adhesive accessory to the GP[®]1 membrane system.

Self adhesive membranes are bituminous membranes, composed of self-adhesive SBS polymer modified bitumen incorporating an upper membrane element, and a lower surface finish of siliconized release film. The type of SAM is dependent on the application scenario as prescribed below, and they are generally used for the gas/waterproofing of underground structures where harmful ground gasses are anticipated, and as a self-adhesive accessory to GP[®] membrane systems.

JUTA UK – radon, ground gas, vapour, air and moisture barrier characteristic properties:

- High Chemical Resistance
- High resistance to Ground Gasses
- Long Term Durability (Performance guaranteed for the lifetime of the building)
- Compatible with all building materials
- Manufactured to meet the most up to date British Standards and guidance.

Thickness	1.2 mm
Width	0.9 m or 0.3 m
Length	20 m
Weight	1100 g/m ²



Additional Products & Accessories:

- **GP[®] Primer** is a low viscosity quick drying primer. The primer is modified to provide improved damp substrate tolerance and membrane bonding relative to non-modified bituminous primers. GP Primer can be applied directly onto green concrete, masonry, metal and wood. It should be applied without thinning and should be brush or roller applied to ensure an even coverage. Coverage rate 6-10m² / litre depending on porosity of substrate, and drying time 30–60mins depending on conditions. Supplied in 5 or 25 litre drums. Please refer to GP Primer TDS for further information on coverage rates.
- **GP[®] Protection Board** is a high density board which are supplied in 3.0mm x 1.2m x 2.4m sizes.
- **GP[®] Protection Fleece** is a 300g nonwoven geotextile and is supplied in 2m x 100m rolls.
- **PD1700** is a geo composite drainage and protection board to be used as protection on below ground applications. The dimpled profile of the membrane creates a void between the earth and membrane to avoid hydrostatic pressure onto the membrane and aid the path of drainage down external land drain locations.

General Precautions:

- It is recommended that JUTA self adhesive membranes are installed in ambient air temperatures in excess of 10°C.
- Ingress of water into the installation area should be prohibited.
- In all cases, the surface onto which the Barrier is to be applied should be smooth, dry, clean and free from debris or detritus material which may cause damage to the Barrier.
- In all cases it is recommended the installation of barrier geomembranes is completed by a suitably qualified and accredited installers (NVQ level 2/TWI/CSWIP or equivalent). JUTA UK can offer advice as to suitable/recommended installers.
- Appropriate PPE should be worn at all times during handling, placement and fixing of the Barrier.
- Vehicular traffic directly on top of the barrier should be avoided.
- Foot traffic directly on top of the barrier should be restricted.
- Where either Vehicular or Foot traffic is unavoidable, protective measures should be utilised to prevent damage to the Barrier. (Use of protection fleece and/or protection boards)
- Smoking, and naked flames are strictly prohibited.
- GP[®] Membranes should not be left exposed for prolonged periods and should be covered as soon as practically possible to prevent UV degradation..



General Installation Notes:

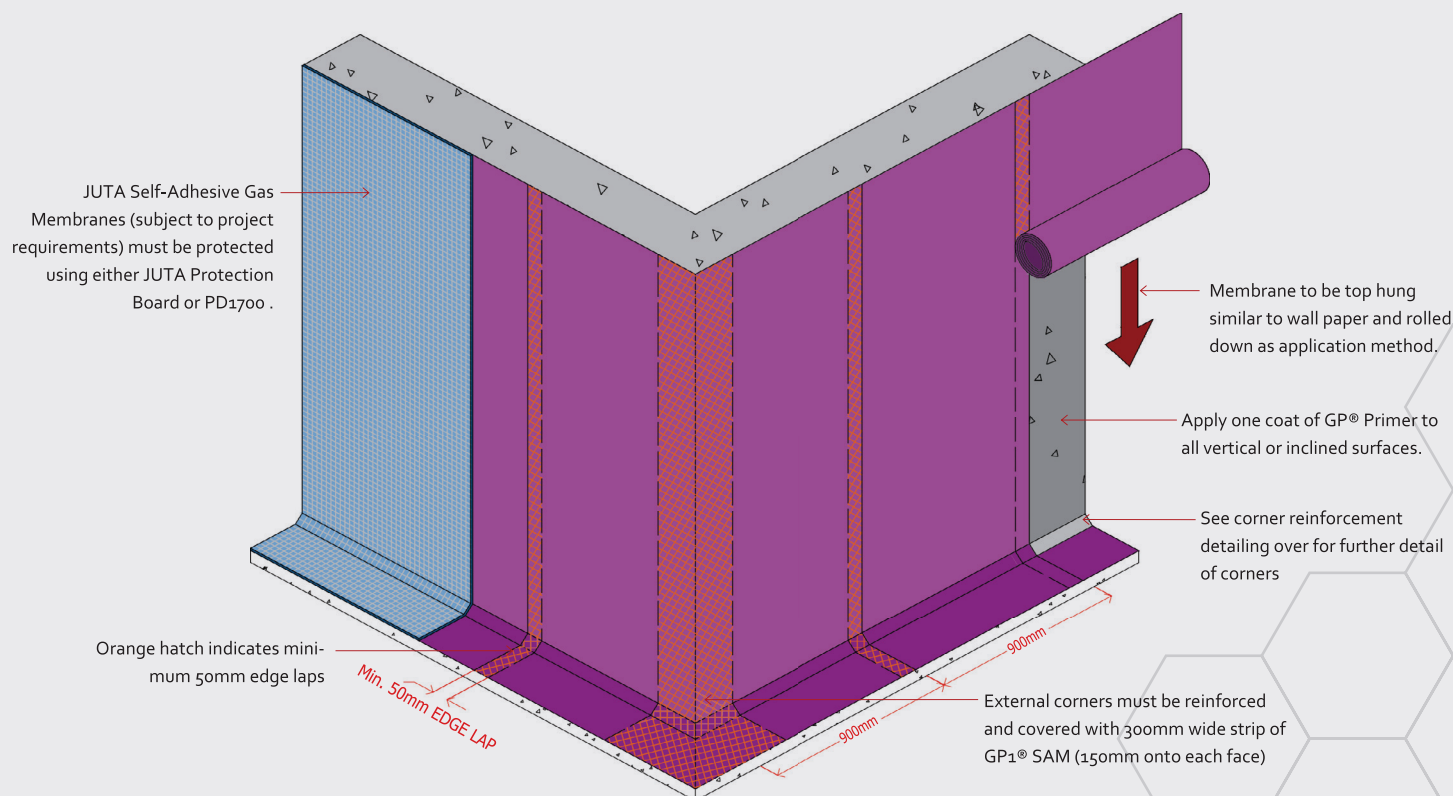
- All construction should conform to the Building Regulations, Codes of Practice and British Standards in current use at the time the building is being constructed. It is recommended that reference is made to BS8102:2009, and BS8485:2015.
- All surfaces should be smooth clean, dry (to a depth of 1-2mm), sound and free from frost, oil, grease, condensation and other contamination. Any voids or hollows must be made good to a flush finish with a suitable filler. Any sharp edges or high points should be eliminated. Powdery or flaking surfaces should be removed by suitable means. Internal corners should be eased with a min. 40 x 40mm cement fillet, to assist application, similarly, external corners should be chamfered or rounded where required.
- Concrete surfaces: Horizontal surfaces should preferably be smooth, however lightly tamped (3-4mm peak to trough profile), brushed or floated surfaces may also be acceptable.
- Masonry: Should be sound with joints flush pointed before the membrane is applied. Open textured surfaces should be sealed with a sand/cement slurry or render to provide a suitable surface. If existing surfaces are very rough, they may require rendering.



Application Method:

- Application of Self adhesive gas membranes should not be attempted in temperatures below 10°C.
- Apply one coat of GP[®] Primer to all vertical or inclined surfaces. The primer should be applied where required by brush, roller or spray at a coverage of approximately 7m²/litre (Refer to TDS for coverage info). GP[®] Primer should dry in 30–60mins depending on site conditions. GP[®] Primer should be covered as soon as it is dry and should not be left exposed for longer than seven days. Do not use GP[®] Primer on insulation boards or insulated concrete formwork (ICF) systems. Contact JUTA for further information if required.
- Vertical applications should be supported immediately after application, or temporary support provided. Maximum unsupported height of membrane should not exceed 600mm.
- JUTA self adhesive gas membranes should be applied from the top down similar to wallpaper. Remove the separating paper progressively from one end of the roll, and press the adhesive coated surface firmly onto the prepared substrate. Smooth out the membrane working from the centre to the edges to remove air pockets. Any remaining bubbles should be slit with a sharp knife and re-adhered. Patches of sufficient size must then be applied over the slits or any other damaged areas to maintain a minimum overlap of 100mm. A hard roller (silicone) should then be used to firm down the whole area.
- Subsequent rolls should then be lapped onto the previous roll. Edge laps should be a minimum of 50mm, onto the backing film, and end laps 100mm. The overlaps should not be primed, but should be rolled with a hard roller, to ensure good adhesion.
- JUTA self adhesive gas membranes are not designed to be left exposed and should be protected from U.V. light within 28 days of application.
- Internal angles and corners should eased with a min. 40mm cement fillet and be reinforced with a 300mm strip of SAM applied into the angle. The full membrane should then be dressed into the angle to form a triple layer. External corners should be covered with a 300mm wide strip of GP[®]1 SAM. GP[®]1 SAM is available in 300mm wide rolls to assist in carrying out angles and projections.

Application Method





Corner Detailing:

All 90 degree corners should be suitably reinforced to ensure robust corner detailing:

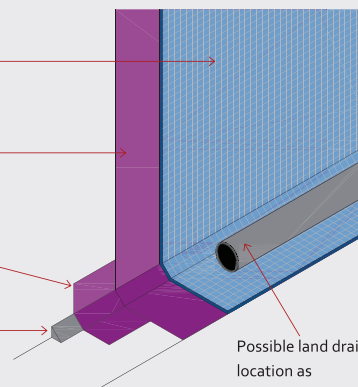
- Any internal corners should be eased with a minimum 40mm sand/ cement fillet to assist application.
- A 300mm band of JUTA Self adhesive gas membrane (subject to project requirements) is applied into the corners lapping 150mm onto the wall and 150mm onto the toe/ screed below slab as project specific detail. Ensure that the wall is primed prior to installation of corner reinforcements.
- JUTA self adhesive gas membrane (subject to project requirements) is applied to the wall and overlaps the corner reinforcement. The membrane should be protected with JUTA PD 1700 as soon as practically possible and backfilled.

Ensure that the membrane is protected with JUTA PD 1700 as soon as possible to avoid UV degradation

JUTA Self-Adhesive Gas Membrane applied to wall over lapping reinforced corner.

300mm band of JUTA SAM applied over fillet and corner to provide 150mm lap onto each face

Minimum 40 x 40mm sand/ cement fillet provided to all corners to remove the 90 degree angle



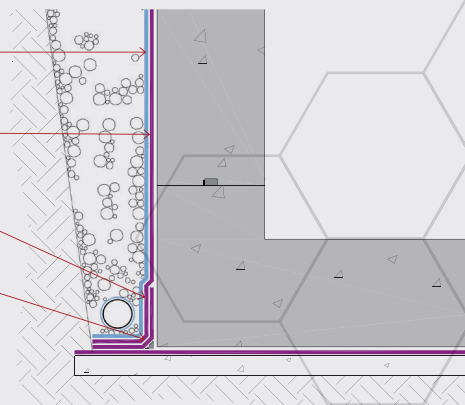
Possible land drain location as BS8102:2009 recommendations

Ensure that the membrane is protected with JUTA PD 1700 as soon as possible to avoid UV degradation

JUTA Self-Adhesive Gas Membrane applied to wall over lapping reinforced corner.

300mm band of JUTA SAM applied over fillet and corner to provide 150mm lap onto each face

Minimum 40 x 40mm sand/ cement fillet provided to all corners to remove the 90 degree angle





Stanchion Detailing:

Sealing around stanchion using JUTA self adhesive gas membranes can be achieved with the following method:

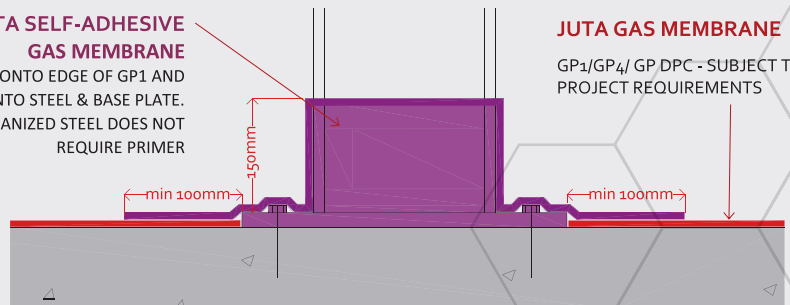
- Cut square or rectangle in the propriety GP[®] Membrane to suit the steel baseplate dimensions. Ensure that membrane is laid as tightly as possible around the baseplate.
- With the membrane in place, JUTA self adhesive membranes is cut and applied to the steel around the flanges to create a good seal extending a minimum 150mm up the vertical face of the steel. The GP[®]1 SAM should then overlap and seal to the GP[®]1 Membrane providing a minimum 100mm lap.

**JUTA SELF-ADHESIVE
GAS MEMBRANE**
APPLIED ONTO EDGE OF GP1 AND
LAPPED ONTO STEEL & BASE PLATE.
NB - GALVANIZED STEEL DOES NOT
REQUIRE PRIMER



JUTA GAS MEMBRANE
GP1/GP4/ GP DPC - SUBJECT TO
PROJECT REQUIREMENTS

**JUTA SELF-ADHESIVE
GAS MEMBRANE**
APPLIED ONTO EDGE OF GP1 AND
LAPPED ONTO STEEL & BASE PLATE.
NB - GALVANIZED STEEL DOES NOT
REQUIRE PRIMER





GP[®] DUCTSEAL[®] + GREY STUFF

HG

GP[®] DuctSeal HG (Water & Gas) is a NEW duct sealing system that is extremely flexible in its ability to seal large, heavy cables & pipes in ducted networks to protect and stop the ingress of harmful or flammable gases, liquids, smoke and vermin.

GP[®] DuctSeal HG comes complete with our PATENT PENDING unique tubular rubber backing system that can be joined together in a long continuous strip, joined to make a ring/collar, but best of all, joined in a cross shape to create a perfect shape for separating trefoil/triplex cables. This unique design endures DSEAR compliance but also aids the installer as it's simple & quick to create the support & separation on large cables or pipes. The PATENT PENDING ULTIMATE backing system, which is one of a kind, is combined with our NEW Fybird flexible intumescent, zero halogen, & zero Meko adhesive and sealing compound, Grey Stuff. All are designed and manufactured in the UK.

GP[®] DuctSeal HG, along with Grey Stuff, is a non-hazardous, superior single component, neutral curing sealant that has been specifically developed to cope with the harsh environments around duct openings to ensure ducted networks and penetrations are protected.

Sizes 50mm to 200 mm
(off the shelf)

Complies with DSEAR duct sealing regulations

WIMES compliant

Complies with 2011 NEC Articles 225.27, 230.8, 300.5(G), 300.7 (A) on Raceway Seals, and 501.15 (B)(2)

Petrol station forecourt accepted, as per the technology described in the APEA Blue ATEX

**Complaint - contains no moving parts or any form of material that can create a spark
Flame Retardant - tested to UL94**

TITANTECH[®]

For developers of brownfield and contaminated sites the TITANTECH[®] family of products represent a major step forward in safeguarding projects against gaseous and chemical contamination.





Part No.	Product	Duct Opening Max	Unit Sold
Using 1 x GP® DuctSeal HG Kit up to 100mm			
DSHG100	GP® DuctSeal HG	100mm	1 x DSHG 100 Kit
Using 2 x GP® DuctSeal HG Kit up to 100mm			
DSHG150	GP® DuctSeal HG	150mm	2 x DSHG 100 Kits
Using 3 x GP® DuctSeal HG Kit up to 100mm			
DSHG200	GP® DuctSeal HG	200mm	3 x DSHG 100 Kits
Using 4 x GP® DuctSeal HG Kit up to 100mm			
DSHG225	GP® DuctSeal HG	225mm	4 x DSHG 100 Kits
Using 5 x GP® DuctSeal HG Kit up to 100mm			
DSHG250	GP® DuctSeal HG	250mm	5 x DSHG 100 Kits

JUTA UK

Please contact JUTA
UK Directly for more
information on
GP® DuctSeal HG

Benefits

- Water & Gas tight to 2.0 bar
- Non-slumping
- High bonding strength
- Odourless when curing
- Flexible
- Intumescent
- UV & Ozone resistant
- Non-hazardous
- Zero halogens used
- Emits 0% MEKO
- Very strong porous sticky char is formed when exposed to fire, which has excellent thermal insulation properties
- Microbial resistance - coverage against fungi, E-Coli, Escherichia coli, Staphylococcus aureus, & A. brasiliensis
- Resistant to Hydrocarbons (Petrol, Diesel, ASTM oil, & LPG Gas)
- Resistant to many other gases & liquids, for example, ADBLUE, & Antifreeze
- Complies with DSEAR duct sealing regulations
- WIMES compliant
- Complies with 2011 NEC Articles 225.27, 230.8, 300.5(G), 300.7 (A) on Raceway Seals, and 501.15 (B)(2)
- Petrol station forecourt accepted, as per the technology described in the APEA Blue ATEX
- Complaint - contains no moving parts or any form of material that can create a spark

Flame Retardant - Tested to UL94





Feature	Characteristics
Density	1.27
Colour	Anthracite Grey
Skin Over Time	10 mins
Curing	3-4mm per day
Tack Free Time	22 mins
Hardness	35 to 38 Shore A
Elongation	250%
Flow	3.33 million cPS at 380°C

Feature	Characteristics
Tensile Strength	0.72 N/mm ²
Density	+5 to 40°C
Temperature Resistance	-35 to +120°C
Intumescence Activation Temperature	210°C
Pressure Resistance	2.0 Bar
Shelf Life	12 months

JUTA UK

Please contact JUTA
UK Directly for more
information on
GP® DuctSeal HG

One Kit per Box

All components included to seal 1 x duct as per the kit size mentioned (Caulking gun not included, but can be sold separately). ** One kit may fill more than one duct, depending on cable % fill. Call **01772 754177** for advice**

Cable Separation

It's imperative to ensure separation between each cable and from the inside of the duct. Our unique daisy-chained circular tubes easily separates and supports single or multiple cables.

Using our patent pending tubular rubber tubes, various shapes can be made to help with cable separation, for example, trefoil/triplex cables.

Running Water

The duct & cables should be dry for best results with no running water. All dirt, oil or grease must be cleaned before applying Grey Stuff. If you have running water, please contact JUTA for advice on **01772 754177**.

Cure Time

Grey Stuff will cure 3-4mm daily, depending on the humidity and temperature. The higher the humidity%, and temperature, the quicker grey Stuff will cure. A minimum requirement of 20mm Grey Stuff is required for an effective seal.

Cleaning

Uncured material spillages can be cleaned with a solvent-based wipe.

Health & Safety

Grey Stuff is based on a neutral curing system that is hazardous-free to protect users when carrying out tasks like sealing cable ducts. Non-hazardous Zero MEKO.



JUTA UK

Please contact JUTA
UK Directly for more
information on
GP® DuctSeal HG

Re-entry & Removal

Grey Stuff will cure to a similar hardness of a rubber eraser, so re-entry and removal are achievable. The ease of this depends on the type of tools used. For example, a sharper tool will be easier than a blunt-ended tool. Only use sharp tools when cables are de-energised. JUTA accepts no responsibility for damaged cables.

Cable Suitability

Grey Stuff is a single-component neutral curing system containing no solvents. Our Formulation does not damage the properties of a cable sheath or stain surfaces.

Storage

Grey Stuff should be kept in a cool, dry environment and away from sunlight. Product shelf life is 12 months. Once opened, any remaining product can still be used for 1 month afterwards, provided the screwcap is securely fitted.