

21st March 2019

Our ref: GE15735/GR02/190321

James Richards
Linden Homes South
1A Guildford Business Park
Guildford
Surrey
GU2 8XG



Dear James,

RE: Plots 1-6, 13-18 and 24-37, Bartons Road, Havant

Further to your instruction, we write to verify the remediation measures completed on the above plots on the Bartons Road, Havant development.

Remediation Measures

The site is located on sloping ground and plot levels vary across the site. In addition, the presence and depth of Made Ground also varied across the site, as demonstrated through various phases of intrusive investigation. As such remedial measures were set out in the Remediation Method Statement, RMS, (GE15375-RMS-SEP16v1.1) and were based on implementation for specific groups of gardens/areas of the site. An extract of Table 4.1 and of Schematics 1 and 2 from the RMS are presented below and provided plot specific guidance on the remedial strategy to be adopted.

Plot	Level change (m)	Remediation strategy
1-6	-0.1 to -0.3	Amenity soft landscaping only. Install separator and geogrid mesh over formation and Topsoil cover.
7	-0.7 to -0.4	Reduced dig to remove Made Ground. Place subsoil (if required) and Topsoil to achieve development level.
8	-0.4 to 0	Reduced dig to remove Made Ground. Place subsoil (if required) and Topsoil to achieve development level.
9	-0.5	Reduced dig to remove Made Ground. Place subsoil (if required) and Topsoil to achieve development level.
10	+0.6 to +0.8	Install soil cover system as per Schematic 1 if Made Ground is present.
11	+0.7	Install soil cover system as per Schematic 1 if Made Ground is present.
12	+0.6 to +0.4	Install soil cover system as per Schematic 1 if Made Ground is present.
13	+0.5 to +1.0	Install soil cover system as per Schematic 1 if Made Ground is present.
14	+0.5	Install soil cover system as per Schematic 1 if Made Ground is present.
15	+0.9 to +1.0	Install soil cover system as per Schematic 1 if Made Ground is present.
16	+0.7	Install soil cover system as per Schematic 1 if Made Ground is present.
17	-0.5 to -0.7	Reduced dig to remove Made Ground. Place subsoil (if required) and Topsoil to achieve development level.
18	-0.5 to -0.9	Reduced dig to remove Made Ground. Place subsoil (if required) and Topsoil to achieve development level.
19	-0.2	Reduced dig and install soil cover system as per Schematic 1 if Made Ground is present at/beneath the exposed formation.

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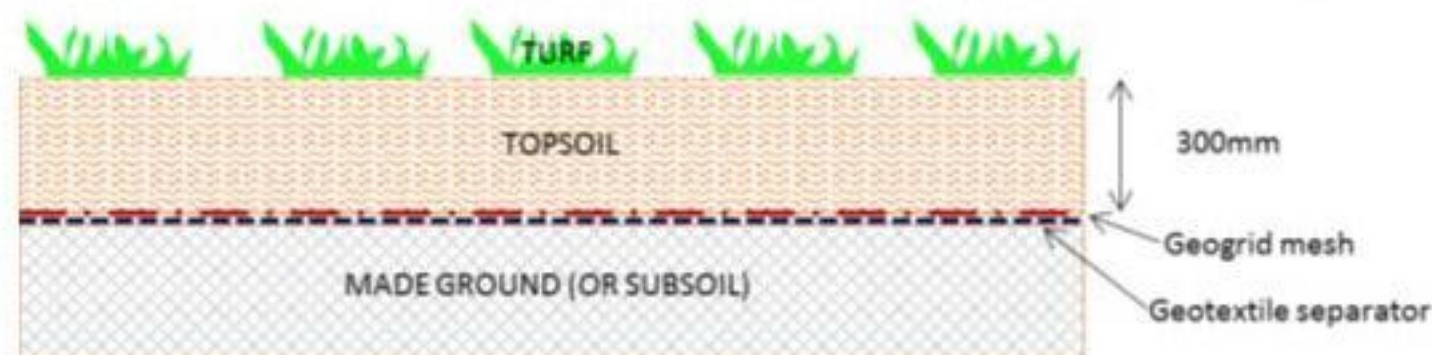


Plot	Level change (m)	Remediation strategy
20	-0.2 to -0.4	Reduced dig and install soil cover system as per Schematic 1 if Made Ground is present at/beneath the exposed formation.
21	-0.5 to -0.1	Reduced dig and install soil cover system as per Schematic 1 if Made Ground is present at/beneath the exposed formation.
22	-0.2 to -0.3	Reduced dig and install soil cover system as per Schematic 1 if Made Ground is present at/beneath the exposed formation.
23	-0.1 to -0.4	Reduced dig and install soil cover system as per Schematic 1 if Made Ground is present at/beneath the exposed formation.
24	-0.4	Reduced dig to remove Made Ground. Place subsoil (if required) and Topsoil to achieve development level.
25	-0.4 to -0.5	Reduced dig to remove Made Ground. Place subsoil (if required) and Topsoil to achieve development level.
26	-1.0	Reduced dig to remove Made Ground. Place subsoil (if required) and Topsoil to achieve development level.
27	-0.7 to -1.0	Reduced dig to remove Made Ground. Place subsoil (if required) and Topsoil to achieve development level.
28	-0.1 to -0.8	Reduced dig to remove Made Ground. Place subsoil (if required) and Topsoil to achieve development level.
29	+0.3 to +0.5	Install soil cover system as per Schematic 1 if Made Ground is present.
30-37	Variable	Reduced dig to remove Made Ground from main garden areas. Place subsoil (if required) and Topsoil to achieve development level. Apply Schematic 2 soil cover in any 'no-dig' zone.
38-55	Variable	In previously undeveloped area where Made Ground is not anticipated. Watching brief and discovery strategy to remain in place.

Table 4.1 Summary of ground level variations by plot (from existing to finished development level)



Schematic 1 Topsoil and subsoil cover system where Made Ground is present beneath gardens



Schematic 2 Soil cover system in tree protection 'No-dig' zone

In addition, the RMS stated the following after Table 4.1: *In areas where no remedial action is required, or where Topsoil is to be placed directly on to subsoil, a minimum thickness of 150mm of suitable Topsoil is recommended.*

Verification of the soil cover system emplaced for Plots 7-12 and 19-23 was undertaken on each plot by a representative from Geo-Environmental on the 10th of May 2017 and is summarised in Table 1 below. In addition, a selection of validation photographs is appended to this letter.

Plot	Soil cover system installed	Comments
1 – 6 side to Bartons Road	Geomembrane, geogrid and 200mm Topsoil	RMS requirements complied with for communal soft landscaping.
1 – 6 side to railway line	Geomembrane, geogrid and 150mm Topsoil	RMS requirements complied with for communal soft landscaping.
1 – 6 verge to car park	200mm Topsoil laid over clay soils	Grassed verge to parking bays
13 – 16	Site strip and reduced dig to facilitate retaining wall construction. Garden levels raised using clay soils to formation prior to placement of geomembrane, geogrid and soil cover.	Compliant with the RMS and Schematic 1.
17 – 18	Reduced dig exposed natural clay soils. Topsoil 150mm thick laid directly on natural soils.	Compliant with the RMS for Topsoil being placed directly on to natural subsoil.
24 – 27	Reduced dig observed during initial stages of construction exposed natural soils. Topsoil was placed directly on to clay subsoil. Topsoil placed 300-400mm thick.	Compliant with the RMS. The thickness of Topsoil placed exceeded the minimum 150mm required for placement on subsoil.
28	Plot subject to reduced dig which exposed subsoil. Topsoil placed 250mm thick over subsoil.	Compliant with the RMS.
29	Plot subject to reduced dig which exposed subsoil. Topsoil placed 300mm thick over subsoil.	Compliant with the RMS.
30 – 36	Reduced dig across these plots to facilitate construction of piled foundations and sheet pile retaining wall in gardens. The reduced dig removed Made Ground and exposed natural subsoils on to which a granular piling mat was laid at construction formation level. Gardens completed with paved areas on the lower garden level and soil cover on the higher level (behind the retaining wall). No dig zone soil cover system installed as per Schematic 2, apart for Plot 36 where 300mm thick Topsoil was placed on subsoil.	Generally compliant with the RMS, albeit with soil cover on Plot 36 varying from that predicted.
37	Reduced dig across Plot 37 to facilitate piled foundation construction. The reduced dig exposed gravelly clay subsoil. 200mm of Topsoil was placed on to the subsoil.	This was a departure from the predicted mitigation due to the exposure of the gravelly clay subsoil and thus Topsoil was placed directly on to subsoil in accordance with the specification. The Topsoil thickness placed exceeded the minimum 150mm required for placement on subsoil.
38 - 55	No specific measures proposed but a Discovery Strategy was to be maintained.	No discoveries or abnormal conditions encountered during construction.

Table 1 Garden cover verification summary

The placement of the soil cover system was undertaken as part of final landscaping of these plots. The depth of the soil cover placed was verified to conform to the requirements set out in the RMS through the excavation of a series of pits excavated using hand tools.

Discovery Strategy

In line with the recommendations presented in the RMS, a Discovery Strategy remained in place throughout the development of this site. It is confirmed that no abnormal conditions or previously undiscovered contamination were encountered and thus the processes set out in the Discovery Strategy did not require enacting.

Conclusions

The recommended risk mitigation measures have been incorporated in to the development and through routine inspection, the measures have been validated.

We trust we have interpreted your request correctly and provided sufficient information to satisfy the NHBC and Local Authority. Should you have any queries please do not hesitate to contact us.

Yours sincerely
For and on Behalf of Geo-Environmental

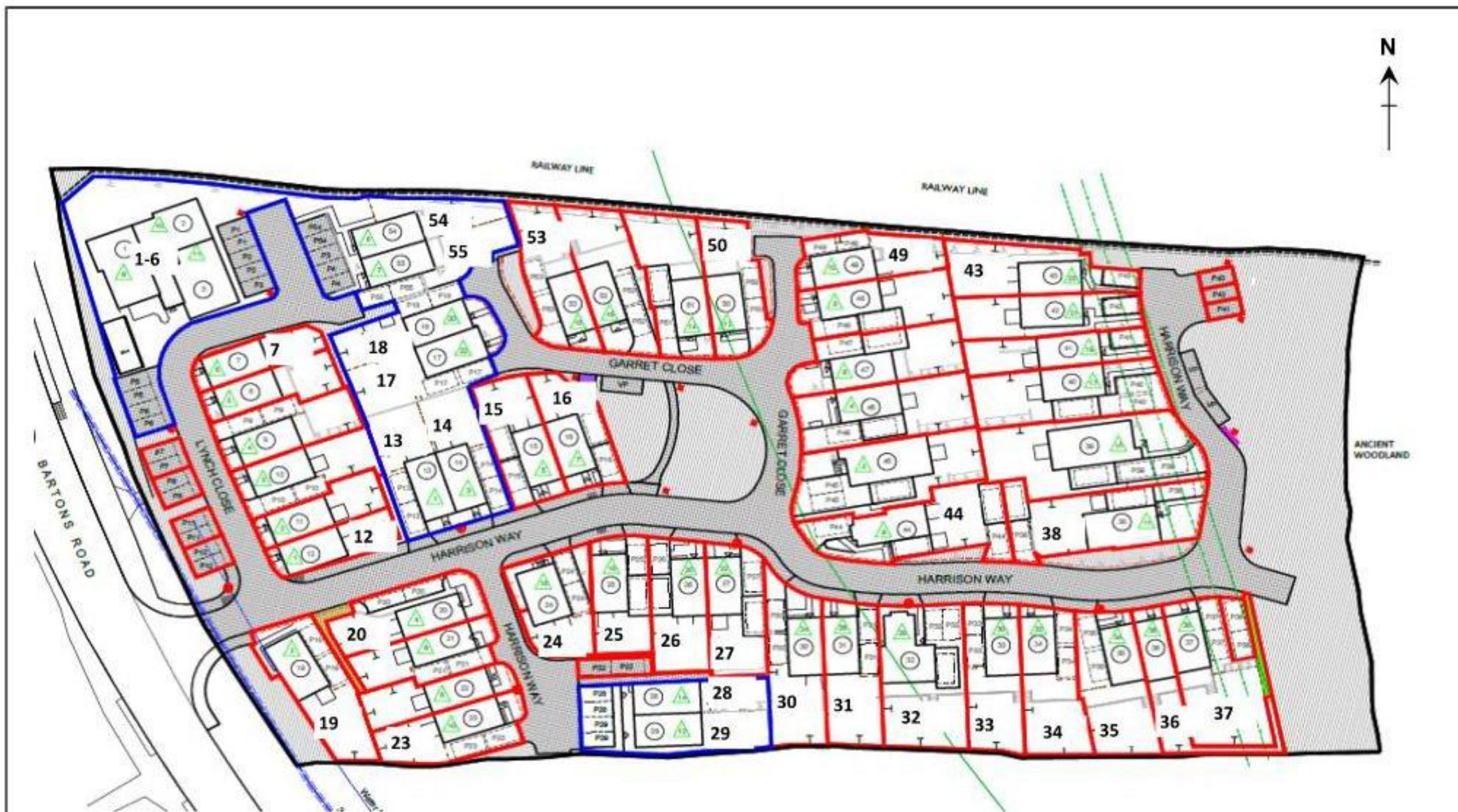


GAVIN ROBERTS CGeol, BEng (Hons), MSc, FGS
Technical Director



Enc Plot Plan
Photographic Record





Project:	Bartons Road, Havant			Title	Plot Reference Plan	
Client:	Linden Homes			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net	 Geo-Environmental	
Ref No:	GE15735	Revision:	0			
Drawn:	FG	Date:	08/03/2019			
Figure:	1	Scale:	Not To Scale			



Plate 1 Plots 13-16 Gardens prior to placement of membrane, geogrid and soil cover



Plate 2 Plots 13-16 exposed soil formation prior to membrane, geogrid and soil cover placement



Plate 3 Plots 25-27 Topsoil being placed



Plate 4 Plot 27 to 24 Topsoil placed



Plate 5 Plot 37 looking to Plot 30 reduced dig prior to retaining wall installation and house construction



Plate 6 Reduced dig level change between Plot 30 and Plot 29 (piling mat placed in base of reduced dig)



Plate 7 Reduced dig in rear of Plot 37 exposed natural soils



Plate 8 Sheet pile retaining wall looking from Plot 30 towards Plot 37



Plate 9 Plot 1-6 Pit between flats and Bartons Road



Plate 10 Plot 1-6 Pit between flats and railway cutting boundary



Plate 11 Plot 1-6 Pit beside parking to rear of flats



Plate 12 Plot 13



Plate 13 Plot 14



Plate 14 Plot 17



Plate 15 Plot 18 Topsoil



Plate 16 Plot 25



Plate 17 Plot 26



Plate 18 Plot 27



Plate 19 Plot 28



Plate 20 Plot 29



Plate 21 Plot 31



Plate 22 Plot 33



Plate 23 Plot 36



Plate 24 Plot 37 (to rear of house)



Plate 25 Plot 37 (rear side garden)