



## 6. REVISED CONCEPTUAL SITE MODEL & RISK ASSESSMENT

### 6.1 Conceptual Site Model

The preliminary Conceptual Site model (CSM) developed as part of the desk-based study has been revised taking into account the findings of the site investigation by LMB.

#### 6.1.1 Sources

The following sources of contamination have been identified during the site investigation works:

- Isolated leachable arsenic in excess of the DWS and nickel in excess of the EQS.
- Leachable copper and lead in excess of the EQS.
- Low concentrations of soil gas and volatile organic vapours.

#### 6.1.2 Pathways

The potential pathways that have been identified are:

- *Direct contact* – ingestion and dermal contact with contaminants that may be present at or near the surface.
- *Inhalation* – inhalation of particles, ground gases, vapours and fibres which may be present at the site.
- *Permeable soils* – the Made Ground and Lynch Hill Gravel beneath the site is likely to have sufficient permeability to allow vertical and lateral migration of soluble contamination and gases / vapours. The underlying London Clay Formation is likely to limit potential further vertical migration of contamination into deeper strata and groundwater (e.g. within the sandy layers of the Lambeth Group or the Chalk).
- *Migration via groundwater* – contamination has the potential to migrate laterally potentially impacting surface water receptors such as the River Thames.



- *Deep structures* – piled foundations and other deep structures may act as preferential pathways for contamination potentially present in the near surface soils and the shallow aquifer if they are constructed into the Lambeth Group or deeper.

### 6.1.3 Receptors

The potential sensitive receptors associated with the site redevelopment are:

- *Future site users* – this includes future residents, staff, workers and visitors who may be exposed to shallow contamination in landscaped areas.
- *Construction workers* – construction workers could be affected by contamination present at the site during demolition and groundworks.
- *Neighbours* – residential and commercial neighbours who could be impacted during ground disturbance works.
- *Groundwater* – the Lynch Hill Gravel is classed as a *Secondary A* aquifer and may be impacted by leachable contaminants in the soil. The Lynch Hill Gravel is underlain by the cohesive London Clay Formation.
- *Surface waters* – the River Thames is located approximately 1km south-east of the site and could be impacted by migrating groundwater.
- *Buildings and services* – underground structures such as building foundations and services may be impacted by chemically aggressive ground conditions. Soil gases can migrate into buildings and pose a risk to building occupants.

## 6.2 Assessment of risk

The above conceptualisation of the source, pathway, receptor contaminant linkage model provides information to allow the following qualitative risk assessment to be made in accordance with the requirements of CLR11<sup>4</sup>. In order to assess the risk posed by the various source-pathway-receptor linkages that may exist, the following risk rating terminology has been adopted to describe the risks identified at the site and is based on the site prioritisation and categorisation rating system set out in CLR Report No. 6<sup>9</sup>:

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<sup>9</sup> Department of Environment. 1995. *Contaminated Land Research Report: Prioritisation and Categorisation Procedure for Sites which may be Contaminated*.



**High risk:** Contaminants are very likely to represent an unacceptable risk to receptors. The site is probably not suitable for its proposed use. Enforcement action is possible.

**Medium risk:** Contaminants likely to represent an unacceptable risk to identified receptors. The site is probably not suitable for its proposed use. Action is required in the medium term.

**Low risk:** Contaminants may be present but unlikely to result in an unacceptable risk to identified receptors. The site is probably suitable for proposed use. Action is unlikely to be needed whilst the site remains in its current use.

**Negligible risk:** If contamination sources are present they are considered to be minor in nature and extent. The site is suitable for its proposed end use. No further action is required.

A preliminary assessment of the risks posed by the identified pollutant linkages have been presented in Table 5.

**Table 5: Preliminary risk assessment**

Source	Receptor	Exposure Pathway	Risk Rating
Leachable metals within the shallow Made Ground in excess of either DWS or EQS (i.e. nickel, arsenic, copper and lead)	Future site users	Direct ingestion of soil and dust, inhalation of particulates, ground gas, vapours and fibres and dermal contact	<b>Low</b> – Soil contaminants are below the relevant human health screening criteria assuming a residential end use scenario with areas of landscaping. Asbestos has also not been identified in any of the soil samples tested.  The gas monitoring undertaken to date has indicated low concentrations of volatile organic vapours and bulk gases such as carbon dioxide and methane.
	Construction workers		<b>Low</b> – Construction workers may come into direct contact with contamination, if present, in the underlying Made Ground and shallow soils during excavation works.
	Neighbours	Direct ingestion of soil and dust, inhalation of particulates, vapours and fibres	<b>Low</b> – Neighbours, site workers/users on adjacent properties may become exposed to soil dusts, gases and vapours during below ground excavation works. However, contamination in soils has been shown to be below human health screening criteria. Standard construction methods to reduce dust would mitigate risks to acceptable levels.



Source	Receptor	Exposure Pathway	Risk Rating
	Groundwater ( <i>Secondary A</i> aquifer)	Vertical and lateral migration of contaminants through permeable soils and migration via groundwater	<b>Low</b> – Low levels of leachable contamination have been noted in the shallow soils in excess of either one of the EQS or DWS. However, the results are not considered to be significant and none of the contaminants identified exceed both the DWS and the EQS.
	Deep Groundwater (Chalk)	Deep structures (e.g. piles)	<b>Low</b> – Piles penetrating through the London Clay Formation could form a pathway for the vertical migration of contaminants to deeper soil levels. However, the risk is considered to be low given the findings of the investigation to date.
	Buildings and services	Direct contact	<b>Low – Medium</b> – Chemically aggressive ground conditions may be present in the London Clay Formation due to the presence of natural sulphates which could pose a risk of chemical attack to buried concrete structures. A low risk is identified to potable water supply pipes.
Ground gases and vapours	Future site users	Permeable soils	<b>Low</b> – Gas monitoring results has indicated a low risk from bulk gases such as methane and carbon dioxide and from volatile organic vapours.
	Buildings and services		

On this basis of the above qualitative risk assessment, the site is considered to pose a **low** risk overall to human health and the environment, based upon the findings of the recent site investigation works.



## 7. CONCLUSIONS & RECOMMENDATIONS

### 7.1 Conclusions

The site works identified a shallow layer of Made Ground (approximately 1m to 2m thick) underlain by the *Secondary A* aquifer of the Lynch Hill Gravels which ranged in thickness from 1.5m to 3.2m. Standing groundwater depth within the gravels was between 3m and 4m bgl. The London Clay Formation was encountered beneath the Gravels ranging from approximately 19m to 21m thick and was subsequently underlain by the Lambeth Group. Perched groundwater was also recorded in the London Clay and Lambeth Group.

Shallow soil samples obtained during the site investigation do not exceed the relevant screening criteria for a residential land use scenario without homegrown produce and asbestos has not been encountered in the soil samples. Soil leaching tests have noted exceedances of either the DWS or EQS for arsenic, lead, copper and nickel. However, the exceedances are not considered to be significant in nature and, following site redevelopment which comprises predominantly hardstanding at ground level, reduced infiltration will limit the leaching of contaminants from shallow soils. Soil gas monitoring has also indicated that the site conforms to *Characteristic Situation 1* and that gas protection measures are not required.

The site is therefore considered to pose a low risk to human health and controlled waters based on the current information.

### 7.2 Recommendations

The following recommendations are made with respect to the proposed site redevelopment:

1. The risks to human health from shallow soil contamination are noted to be low. Nevertheless, it is likely that a growth medium may be required in areas of soft landscaping in Castlewood House. This material should be from a reputable source, should not be considered a waste and should be tested prior to import to confirm that it poses a low risk to human health and the environment.



2. Should the development proposals change (for example, if private domestic gardens were to be incorporated) then the risks to site users would need to be reassessed.
3. Appropriate construction management procedures should be put in place during groundworks to prevent the generation of dusts.
4. The use of upgraded water supply pipes is not considered likely to be required. This should, however, be confirmed with the utility company.
5. Should areas of suspected contamination be uncovered during the site redevelopment then the discovery strategy set out in Appendix D should be implemented.

# Appendix A

Site development plans



**GB Card**  
& PARTNERS

Design Freeze 04 Area Schedule

Issue Number	Date
04	20/12/2016
05	23/12/2016 Updated B2 / Level 01 GIA

NB: NIA excludes columns  
 GEA measured to external face of cladding zone  
 GIA measured to internal face of cladding zone

Castlewood House												
Level	Floor Heights			Use	GEA		GIA		NIA		Efficiency	
	Floor level	Floor to Floor Height	Height above ground		Proposed GEA -m2	Proposed GEA -f12	Proposed GIA -m2	Proposed GIA -f12	Proposed NIA -m2	Proposed NIA -f12	NIA to GIA	GIA to GEA

Roof	1.500	43.400	69.05	Support								
10	3.350	40.050	65.70	Commercial	319	3,434	300	3,229	82	883	27%	94%
9	3.865	36.185	61.83	Commercial	1,217	13,100	1,173	12,626	890	9,580	76%	96%
8	3.865	32.320	57.96	Commercial	1,217	13,100	1,173	12,626	890	9,580	76%	96%
7	3.865	28.455	54.09	Commercial	1,815	19,537	1,735	18,676	1,445	15,554	83%	96%
6	3.865	24.590	50.22	Commercial	1,815	19,537	1,735	18,676	1,445	15,554	83%	96%
5	3.865	20.725	46.35	Commercial	1,900	20,452	1,827	19,666	1,536	16,534	84%	96%
4	3.865	16.860	42.48	Commercial	2,026	21,808	1,946	20,947	1,648	17,739	85%	96%
3	3.865	12.995	38.61	Commercial	2,046	22,023	1,967	21,173	1,669	17,965	85%	96%
2	3.865	9.130	34.74	Commercial	2,066	22,238	1,990	21,420	1,693	18,223	85%	96%
1	3.865	5.265	30.87	Commercial	1,939	20,871	1,859	20,010	1,570	16,899	84%	96%
GR	5.265	0.000	25.60	Commercial	484	5,210	474	5,102		0		98%
				Retail	945	10,172	898	9,666	889	9,569	99%	95%
				Support	326	3,509	323	3,477		0		99%
SUB-TOTALS	Residential				0	0	0	0	0	0		
	Commercial				16,844	181,309	16,179	174,151	12,868	138,511		
	Retail				945	10,172	898	9,666	889	9,569		
	Support				326	3,509	323	3,477	0	0		
<b>Ground and above</b>					<b>18,115</b>	<b>194,991</b>	<b>17,400</b>	<b>187,294</b>	<b>13,757</b>	<b>148,080</b>	<b>79%</b>	<b>96%</b>

B1	3.500	-3.500	22.10	Support	395	4,252	359	3,864				
				Commercial	645	6,943	634	6,824				
				Retail	1,202	12,938	1,131	12,174	958	10,312		
B2	3.400	-6.900	18.70	Support	852	9,171	775	8,342	0	0		
							0	0				
SUB-TOTALS	Residential				0	0	0	0	0	0		
	Affordable				0	0						
	Commercial				645	6,943	634	6,824	0	0		
	Retail				1,202	12,938	1,131	12,174	958	10,312		
	Hotel				0	0						
	Support				1,247	13,423	1,134	12,206	0	0		
<b>Basements</b>					<b>3,094</b>	<b>33,304</b>	<b>2,899</b>	<b>31,204</b>	<b>958</b>	<b>10,312</b>		

<b>TOTAL</b>					<b>21,209</b>	<b>228,295</b>	<b>20,299</b>	<b>218,498</b>	<b>14,715</b>	<b>158,392</b>	<b>72%</b>	<b>0%</b>
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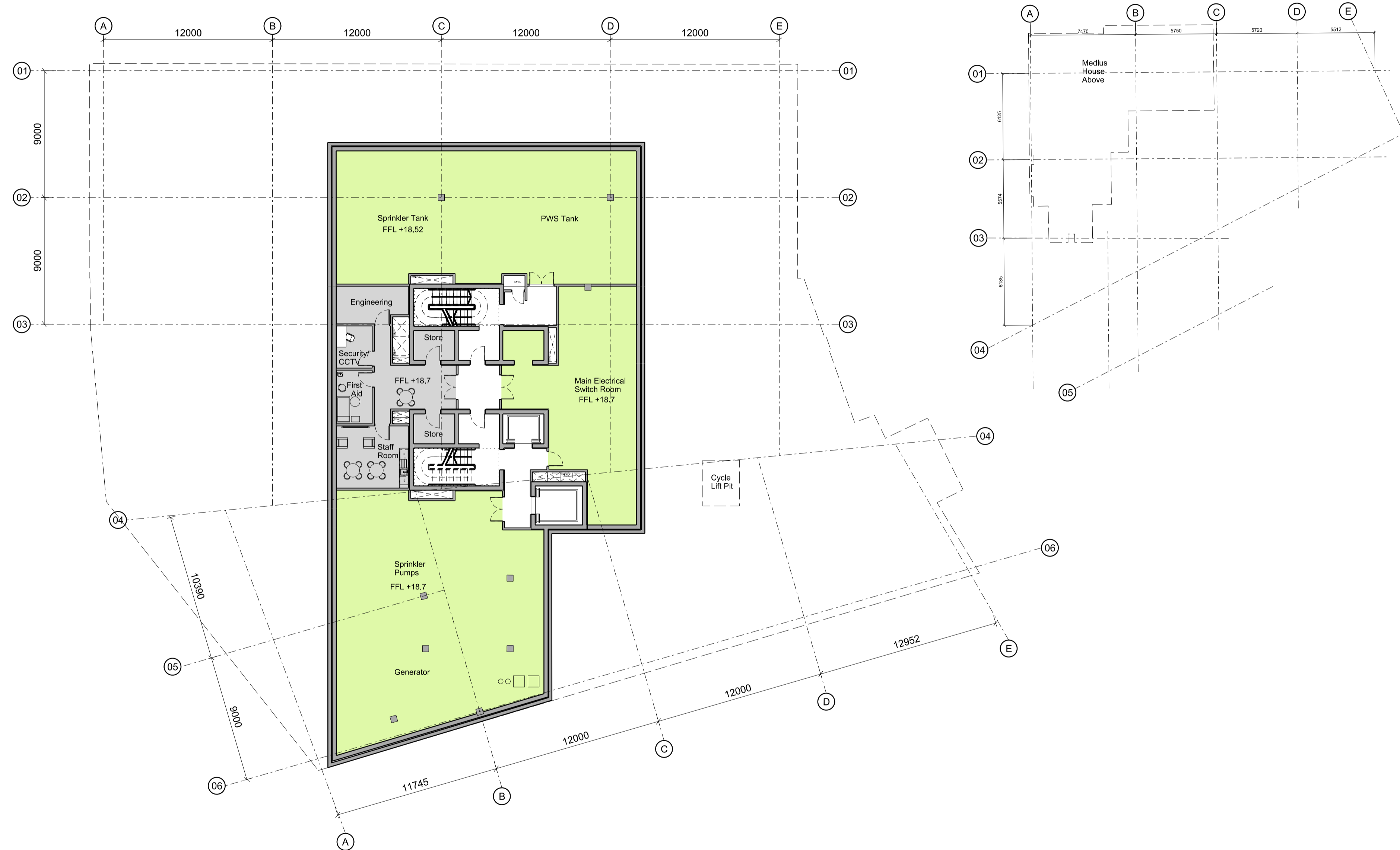
Medius House												
Level	Floor Heights			Use	GEA		GIA		NIA		Efficiency	
	Floor level	Floor to Floor Height	Height above ground		Proposed GEA -m2	Proposed GEA -f12	Proposed GIA -m2	Proposed GIA -f12	Proposed NIA -m2	Proposed NIA -f12	NIA to GIA	GIA to GEA

Roof	2.500	25.84	51.52	Residential	32	344	25	269	0	0	0%	78%
7	3.39	22.45	48.13	Residential	193	2,077	174	1,873	124	1,335	71%	90%
6	3.16	19.29	44.97	Residential	239	2,573	214	2,303	159	1,711	74%	90%
5	3.16	16.13	41.81	Residential	285	3,068	257	2,766	198	2,131	77%	90%
4	3.05	13.08	38.76	Residential	285	3,068	256	2,756	202	2,174	79%	90%
3	3.05	10.03	35.71	Residential	285	3,068	257	2,766	202	2,174	79%	90%
2	3.05	6.98	32.66	Residential	285	3,068	257	2,766	203	2,185	79%	90%
1	3.05	3.93	29.61	Residential	285	3,068	258	2,777	193	2,077	75%	91%
GR	3.93	0.00	25.68	Residential	70	753	58	624	0	0		83%
				Retail	293	3,154	258	2,777	253	2,723	98%	88%
				Support	0	0	0	0	0	0		
SUB-TOTALS	Residential				1,959	21,087	1,756	18,902	1,281	13,789		
	Commercial				0	0	0	0	0	0		
	Retail				293	3,154	258	2,777	253	2,723		
	Support				0	0	0	0	0	0		
<b>Ground and above</b>					<b>2,252</b>	<b>24,241</b>	<b>2,014</b>	<b>21,677</b>	<b>1,534</b>	<b>16,510</b>	<b>76%</b>	<b>89%</b>

B1	3.37	-3.37	22.31	Support	0	0	0	0	0	0		
				Residential	188	2,024	175	1,884	0	0		
				Retail	232	2,497	211	2,271	206	2,217		
SUB-TOTALS	Residential				188	2,024	175	1,884	0	0		
	Affordable				0	0						
	Commercial				0	0	0	0	0	0		
	Retail				232	2,497	211	2,271	206	2,217		
	Hotel				0	0						
	Support				0	0	0	0	0	0		
<b>Basements</b>					<b>420</b>	<b>4,521</b>	<b>386</b>	<b>4,155</b>	<b>206</b>	<b>2,217</b>		

<b>TOTAL</b>					<b>2,672</b>	<b>28,762</b>	<b>2,400</b>	<b>25,832</b>	<b>1,740</b>	<b>18,727</b>	<b>73%</b>	<b>65%</b>
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Notes

Key

Rev	Notes	Date	Dwn	Iss
04	Design Freeze 4	20.12.16	RPP	RPP
03	Design Freeze 3	04.10.16	RPP	RPP
02	Design Freeze 2	05.08.16	RPP	RPP
01	Design Freeze 1	15.07.16	RPP	RPP
00	Base Scheme	29.01.16	RPP	RPP

Consultants  
Structural Engineer: Davies Maguire & Whitby  
M&E Engineer: GDM Partnership  
Cost Consultant: Currie & Brown  
Planning Consultant: Gerald Eve

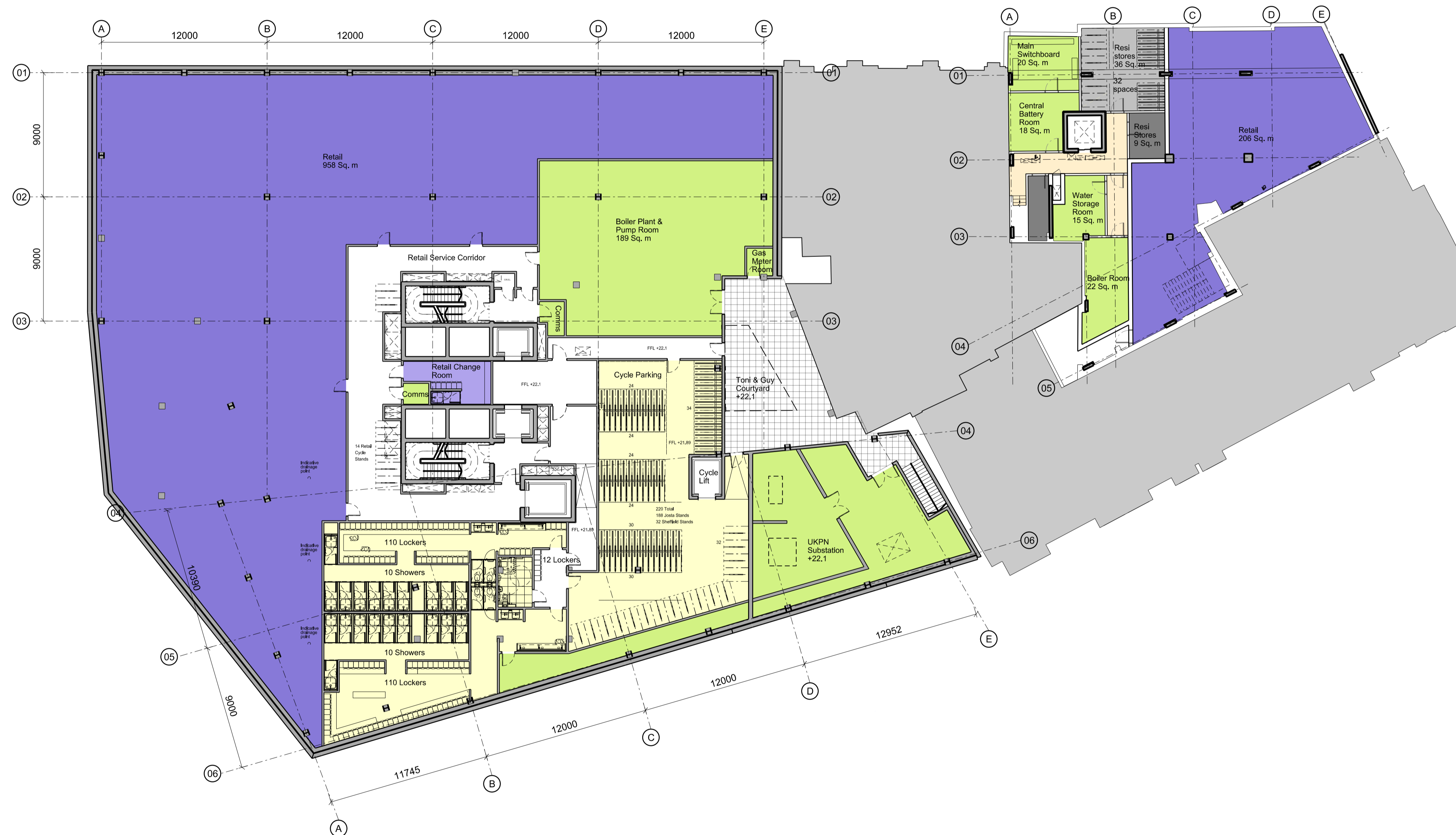


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Project <b>Castlewood House, London, W1A</b>		
Drawing Title <b>General Arrangement Proposed Plan Level B02</b>		
Scale <b>1:200 @ A1</b>	Drawn By <b>RPP</b>	Issued By <b>RPP</b>
<b>DRAFT</b>		
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**01** Level B02  
1:200



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04	Design Freeze 4	20.12.16	RPP	RPP
03	Design Freeze 3	04.10.16	RPP	RPP
02	Design Freeze 2	05.08.16	RPP	RPP
01	Design Freeze 1	15.07.16	RPP	RPP
00	Base Scheme	29.01.16	RPP	RPP

Consultants

Structural Engineer: Davies Maguire & Whitby  
 M&E Engineer: GDM Partnership  
 Cost Consultant: Currie & Brown  
 Planning Consultant: Gerald Eve

Key / Location

1:1500

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**Royal London Asset Management**

Project  
**Castlewood House, London, W1A**

Drawing Title  
**General Arrangement  
 Proposed Plan  
 Level B01**

Scale	Drawn By	Issued By
1:200 @ A1	RPP	RPP

**DRAFT**

Project No.	Drawing No.	Revision
15023	A_PL_P_099	04

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**01** Level B01  
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