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22 King's Mews, WC1N 2JB

BASEMENT IMPACT ASSESSMENT: SCREENING AND SCOPING REPORT

For

Queens Gate Holdings Limited

Project No:

11153

October 2014

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EXECUTIVE SUMMARY

Author Credentials	This report has been prepared by: James Clay: MCIWEM C.WEM, SiLC, CEnv, MSc, BSc Alex Dent: BSc, MSc, EurGeol, C.Geol, FGS Peter Butler: BSc CEng MICE
Data consulted	A site reconnaissance and desk study data has been obtained and reviewed based on the requirements of Section 7.2.1 of the Guidance for Subterranean Development (GSD) produced by the London Borough of Camden.
Development Proposal	The existing building is to be demolished and a new building is to be constructed with a proposed basement excavation formation level of up to 4.55m bgl. Plans illustrating the proposed development are given in Appendix A.
Ground Model	Made Ground up to 4.60m thick over River Terrace Gravel to around 6m bgl over London Clay. An equilibrium groundwater level of 3.60m bgl is anticipated. However, these matters are to be confirmed by site specific ground investigation. Party wall foundations are anticipated to extend to 1.00 to 2.00m bgl.
Screening	Screening concerning land stability, hydrogeology and hydrology was undertaken based on the flowcharts contained in 6.2.2 of the GSD. This identified potential impacts regarding groundwater, previously worked ground, the presence of an adjacent highway and associated services, party wall foundations and tunnels.
Scoping	Scoping was undertaken in relation to the above matters. Most of these were considered to be of negligible or minor significance, with the exception of, worked ground, dewatering (if required) adjacent highways/services and party wall foundations. Residual impacts, which consider the proposed mitigation measures, are separately discussed below.
Investigations and Assessment Methodology	A site reconnaissance was completed and existing desk study data was reviewed as outlined above. Ground investigations containing data relevant to the site have been obtained. It is recommended that client obtains a warranty of this data. It is also recommended that he commissions his own site specific ground investigation based on the requirements of the GSD. A number of additional recommendations are made in relation to consultations and groundwater monitoring as given herein. Calculations will be required for the design of the basement is developed.
Mitigation measures	A number of options for mitigation measures are given in relation to temporary and permanent works, which should be considered as the design is developed. These include the aforementioned investigations, the employment of competent professionals and contractors, adopting suitable foundation solutions, the securing of existing foundations, groundwater control measures and the provision of ground support.
Monitoring	In addition, the existing adjacent boreholes should be used where practicable to facilitate additional groundwater monitoring. A pre and post works condition survey of the potentially affected surrounding buildings and ground is recommended as a minimum. The extent of any additional monitoring during the works to identify movement should be considered as the design is developed.
Residual impacts	Based on the additional investigations and the design measures discussed herein it is anticipated that the matters identified in the screening exercise will be of **residual neutral or minor significance**.
Other	The client will be required to seek party wall awards for the proposed works which comply with current legislation.

1.0 INTRODUCTION

1.1 This report has been produced by Campbell Reith Hill LLP (CampbellReith) on behalf of Queens Gate Holdings Limited, 'the Client'. It provides a Screen and Scoping assessment in relation to a Basement Impact Assessment (BIA) for 22 King's Mews, WC1N 2JB (referred to here after as 'the site'), where it is intended to bring forward a planning application which includes a new basement. The site location is given on 'Plan Level B Proposed', produced by Buchanan Associates and referenced 0645 L(--)101, contained in Appendix A. The references and limitations associated with this report follow the main text.

1.2 The report has been produced in general accordance with the policies and technical procedures for BIA for the London Borough of Camden comprising:

- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners
- Camden Planning Guidance (CPG4) 4: Basements and Lightwells
- Camden Development Policy (DP)27: Basements and Lightwells

1.3 A BIA is required with all planning applications for basements in Camden in accordance with DP 27 to demonstrate that schemes:

a) maintain the structural stability of the building and neighbouring properties;
b) avoid adversely affecting drainage and run off or causing other damage to the water environment; and,
c) avoid cumulative impacts upon structural stability or the water environment in the local area.

The purpose of this report is to evaluate the impacts of the proposed basement considering the issues of hydrology, hydrogeology and land stability via the process described by the GSD and make recommendations. The GSD presents a staged methodology and tool kit which is illustrated by flow charts and checklists. The stages described in the GSD are:

a) Screening;
b) Scoping;
c) Site Investigation and Study;
d) Impact Assessment;
e) Review and Decision Making;

1.4 The report considers the screening and scoping stages of the BIA. This is intended to support the key deliberations during the agreement of planning permission. It is necessary that additional site investigation and study, review and decision making are made after granting of planning during design development.

1.5 It is proposed to develop 22 King's Mews as a 3 storey property with a single storey basement. that extends across the full footprint of the site. The development proposals for the site are presented in Appendix A.

1.6 The report is based on previous phases of ground investigation(reports dated 2007 and 2012), desk study and Envirocheck reports which cover the site area provided by the Client. At the current time the Client does not have the benefit of the reports listed in Table 1.1 and therefore these are not reproduced herein. These reports contain pertinent and relevant information in relation to the site. It is anticipated that the Client will obtain the benefit of the existing information.

1.7 The following site specific information was supplied by the Client and has been viewed in preparation of this report:

TABLE 1.1: EXISTING SITE SPECIFIC INFORMATION

Report Title		Author	Type	Reference
Site Investigation Report 43 and 45 Grays Inn Road and 22 to 30 King's Mews, London WC1. Reference C10885.	March 2007	Ground Engineering	Phase 1 Desk Study and Phase 2 Site Investigation Factual and Interpretative Report	[1]
43–45 AND 49 GRAY'S INN ROAD AND 22–30 KING'S MEWS London WC1 London Borough of Camden Archaeological desk-based assessment.	December 2006	MOLAS	Archaeological Desk Study	[2]
43-45, Gray's Inn Road, LONDON, WC1X 8PP. Reference SAS_34711535_1_1.	May 2011	Landmark Information Group	SiteCheck Report	[3]
25 King's Mews, London, WC1N 2JB Basement Impact Assessment. Reference: 11093/01/001.	August 2012	Techniker	Basement Impact Assessment	[4]

1.8 Reference has also been made to ground investigation and desk study data contained within the CampbellReith GIS database, publicly available information and a site walkover.

1.9 This assessment has been carried out by persons with relevant qualifications listed under the guidance comprising:

James Clay:	MCIWEM C.WEM, SiLC CEnv, MSc, BSc
Alex Dent:	BSc, MSc, EurGeol, C.Geol, FGS
Peter Butler:	BSc CEng MICE

1.10 This commission from the Client did not include for an appraisal of potential contamination issues or allied matters such as waste.

2.0 SITE DESCRIPTION

Site Location

2.1 The site location is given on Drawing 0645 L(--)101 contained in Appendix A. The site is located on King's Mews, off Theobold's Road at London WC1 2JB. It is located in the London Borough of Camden: Holborn and Covent Garden Ward. The site is located at National Grid Reference of 530940 182010 and, based on information provided by the project Architect, is at a level of around 21.10m AOD.

Site Layout

2.2 A visit to the site was made on 13th September 2012 by Alex Dent of CampbellReith. The site is currently occupied by a disused two storey terraced property. The ground across the site is generally level.

2.3 The walls in No 22 were generally covered with plaster, where this had been removed the walls appeared to be of brick construction. Within the building a number of timber columns and beams were noted, suggesting a masonry and timber frame construction. Two notable cracks were observed at ground floor level on the inside of the north-western elevation. These were 2 to 3mm and 5 to 7mm in width. These continued to first floor level where they were 1 to 2mm wide. At first floor level it appeared that former door to No 21 had been crudely reinstated and some cracking was noted in relation to this feature. The whole of the building footprint was covered with a concrete floor slab, which was locally cracked.

2.4 No construction joints were observed to separate No 22 from 23, nor were any construction joints observed to separate No 22 from No 21. However, on the south-western elevation no gross cracking was noted where the structures are joined.

2.5 A historic investigations within and adjacent to the site [Ref 9] indicated that the party wall foundations extend to depths in the region of 1.25m (GE TP7 on northern and eastern elevation) to 2.00m bgl (GE TP9 on the southern elevation). The construction of these variably comprised mass concrete or brickwork over mass concrete. The foundations projected up to 80mm into the site. At all locations where the bottom of the footing was established, the founding stratum comprised Made Ground.

Surrounding Land-Use

2.6 The area in general is of a predominantly residential and commercial nature. There were no trees adjacent to the properties. The adjacent No 23 Kings Mews appeared to be of more modern construction.

2.7 In this part of London a significant proportion of existing properties have basements, as evidenced by stair wells, access hatches, pavement lights (and areas of reinstatement suggestive of such being historically present) and low level windows. Based on such observations it would appear that, in the vicinity of the site, most of the properties along Grays Inn Road, with the possible exceptions of No 35, possess basements. Likewise most of the properties along Theobalds Road (including at the junction with Kings Mews), John Street and Northington Street (including at the junction with Kings mews) have basements.

2.8 With respect to Kings Mews itself, no basements were observed with the exception of the properties at the junction with Theobalds Road (as discussed above) and possible half height basement at a property opposite No 22 Kings Mews, which is set back by around 10m from the road. However a review of information on LB Camdens planning portal indicates a basement was recently constructed at No 1 Kings Mews. It did not indicate the presence of a basement at the recently constructed No. 12 to 15.

2.9 No signs of gross building distress were noted around the site, with the possible exception of No 39 and 45 Gray's Inn road, where some reinforcement plates were noted on the external walls at 1st and 2nd floor level. No 12 Theobalds Road has a notable eastward lean.

2.10 BHA Ltd Drawing No L(--) 107 gives some limited information regarding 51-53 Gray's Inn Road. From discussion with them it is understood that rear terrace is underlain by additional ground level storey, although this is not shown. Whilst pavement lights were noted at the front of 51-53 Gray's Inn Road it is unclear how far back the associated basement extends. The drawing indicates that King's Mews pavement is at 21.10m OD.

2.11 At this stage consultation with the adjacent occupants of properties on Kings Mews and Grey's Inn Road has not been undertaken.

2.12 The nearest observable trees to the site were London Plane trees located approximately 40m east and 70m south of the site. Arial photography suggests some additional trees may be present in courtyards bounded by properties on John Street and Kings Mews.

2.13 A number of manholes and reinstatement scars were noted in the road pavement to Kings Mews, suggesting the possible presence of services.

2.14 The site is in an area with a gentle gradient down to the north. Ordnance survey maps suggest a gradient in the region of approximately 1:40 approx. (1.5º), which agrees well with Figure 10 of the GSD (referred to in section 1.2), which suggests that the site is an area where there is only very limited change to the relief and Figure 16 of the GSD which indicates that the site is remote from an area with a slope angle in excess of 7º.

2.15 No water courses or ponds were noted within 100m of the site.

Site After-Use Proposal

2.16 The proposed site redevelopment is shown in Appendix A. It is proposed to construct a new 3 storey residential house with an additional basement level. It is understood that this will occur at the same time as the re-development of No 23 and No 24 Kings Mews.

2.17 The current street level is approximately 21.10mAOD. At the front the finished basement floor level is anticipated to be at 2.60m bgl. At the rear the finished basement floor level is anticipated to be at 4.10m bgl. A total construction thickness of 450mm is anticipated for the basement floor slabs, therefore a planned excavation levels of 3.05m bgl (18.05m OD) and 4.55m bgl (16.55m OD) are anticipated.

3.0 ENVIRONMENTAL SETTING

Geology

3.1 The site geology is summarised in Table 3.1 and the associated references are listed in Table 1.1 and at the rear of the report. The London Borough of Camden is divided into three distinct areas for the purposes of geology and, in this regard, the site falls into the area to the south of Euston Road (characterised by River Terrace Deposits overlying London Clay). An area of Alluvium exists around 160m to the north east of the site, associated with the historic route of the River Fleet, but such deposits are not likely to be present on site.

TABLE 3.1: SUMMARY OF GEOLOGY

Type	Description	Anticipated Base of Stratum	Reference
Made Ground	Clayey, silty, sandy GRAVEL	3.50 to 4.50m bgl	[9]
Quaternary Drift Deposits	River Terrace Deposits (Lynch Hill Gravel): GRAVEL	6.00 to 6.30m bgl	[9] [5] [6] [7] Figures 2, 3 and 5 of the GSD
Palaeogene Solid Deposits	London Clay Formation: CLAY	25m bgl	
	Lambeth Group (Woolwich and Reading Beds): CLAY with sand and pebble beds	35-40m bgl	
	Thanet Sands: Fine grained SAND	45-50m bgl	
Cretaceous Solid Deposits	Upper Chalk: CHALK	240m bgl	
Other			
Recorded Scour Hollows	None on site. Nearest located 150m North.		[6] [8]
Dissolution Features	Not relevant given geological setting.		[9] [3] [5]
Geotechnical Hazards	With respect to the site itself, 'no hazard' or low or very low potential is recorded in relation to: mining, brine, collapsible ground, compressible ground, landslides, and running sand. This is consistent with other information indicating the site geology and safety.		[3]
Tunnels*	The site is more than 100m from most recorded tunnels indicated on the CampbellReith GIS database. However, it is in the vicinity of the old mid-level sewer. The site is remote from the safe guarding zones associated with Crossrail 1 and Crossrail 2.		[9]

*including indicative locations of London Underground, Network Rail, Crossrail 1, Crossrail 2, Rail Mail, Government Communications, Major Sewers, London Electricity Cable Tunnels, major sewers, and those operated by National Grid.

3.2 London Clay has been demonstrated to a depth of 25m on the site in two boreholes from previous investigations [9].

3.3 The above is comparable with Figure 6 of the GSD which indicates the anticipated thickness of River Terrace Deposits at the site to be between 1.00-1.50m.

3.4 Ref 9 indicates that the Made Ground generally comprises loose, dark brown, slightly clayey, sandy GRAVEL with occasional cobbles of brick, concrete, flint, quartzite and ash with additional inclusions of ceramics, ash and shell fragments varying to loose gravelly sand and soft and very soft clay.

3.5 Ref 3 suggests a moderate potential for shrink-swell hazard. Given the generic nature of such reports and the additional, more detailed, data considered in this report, the risk can be considered to be low. This is justified on the basis that top of the London Clay is anticipated to be around 6m bgl and is overlain by water bearing River Terrace Deposits (see discussion below on groundwater levels) and that the site is remote from trees.

3.6 With reference to Figure 17 of the GSD, the site is not within an area of known significant landslide potential (and this concurs with the known site topography).

Hydrogeology

3.7 The site hydrogeology is summarised in Table 3.2 and the associated references listed at the rear of the report.

3.8 The River Terrace Deposits which are present at the site are designated as a Secondary A Aquifer by the Environment Agency and are the relevant water bearing strata for the consideration of a new basement in this area. London Clay is considered to be an unproductive stratum in this context. The Environment Agency definition of a Secondary A Aquifer is:

*"**Secondary A** - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers".*

3.9 It is also noted that the GSD indicates, in LB Camden, all areas where London Clay does not outcrop at surface are considered to be an aquifer.

3.10 An historic investigation [9] indicates that a cable percussive borehole, 16m south east, encountered groundwater at the top of the River Terrace Deposits at 4.60m bgl, which during

monitoring (February/March 2007)rose to depths between 3.60 and 3.74m bgl. Another borehole, 14m south east, monitored (July 2012) groundwater levels between 3.90 and 4.20m bgl in the River Terrace Deposits. This variation in level could be explained by seasonal factors.

3.11 The River Terrace Gravel deposits form an aquifer and groundwater storage unit in the London Borough of Camden and it is noted that the water levels are often variable therein.

3.12 Groundwater is likely to flow towards the former River Fleet, offset by its direction of flow. Consequently, groundwater flow is likely to be towards the northeast.

TABLE 3.2: SUMMARY OF HYDROGEOLOGY

Type	Distance	EA Description	Reference
Upper Aquifer	On-site	Secondary A Aquifer (River Terrace Deposits).	EA Website
Lower Aquifer	On-site	Unproductive strata (London Clay) underlain by Principal Aquifer (Thanet Sand/Chalk).	EA Website

3.13 The Environment Agency web site did not indicate any groundwater source protection zones or drinking water abstractions within 500m of the site.

3.14 The geological data consulted did not indicate any additional recorded wells within 100m of the site. Nor were such features recorded within 100m of the site on the GeoIndex provided by the British Geological Survey (BGS) (http://mapapps2.bgs.ac.uk/geoindex/home.html).

3.15 With respect to the potential for rising groundwater in the basal Chalk aquifer, the site is not within a critical area for shallow foundations and basements [6]. However, it is close to a critical area for deep foundations and deep basements [6].

Hydrology

3.16 Figure 12 of the GSD, the ordnance survey plans [9], geological data consulted (as discussed above) and the site reconnaissance indicate that the site is more than 100m from surface water features, ponds and recorded spring lines. The nearest existing surface water course to the site is the River Thames, situated 1.2km to the south. Figure 11 of the GSD also indicates the historic tributary of the River Fleet and the River Fleet itself located to the north (approximately 110m [2, 10]). These rivers were artificially culverted along their route and enter the storm drainage network and, in turn, the River Thames.

Flooding

3.17 With reference to data held within the CampbellReith GIS database, the following is noted:

- the site is not within a Zone 1 or Zone 2 flood risk area associated with rivers or the sea;
- site is not in an area of recorded historical flooding;
- the site is not within the areas associated with floods with a return period of up to 1000 years, including pluvial flooding;
- the site is not located in an area of coincident with a BGS geological indicator of flooding;
- with reference to the National Flood Risk Assessment by the environment agency, this site is not in area with an identified flood risk;
- the site it is in an area where there is moderately high *susceptibility* to groundwater flooding.

3.18 Groundwater flooding occurs when groundwater rises to the surface. In this case it would be associated with rising ground waters within the River Terrace Deposits. Such flooding occurs away from river channels. It is noted that much of the area south of Euston Road has moderate to high susceptibility in this regard. *Susceptibility* is not the same as risk and it just indicates sensitivity to such matters: this issue is discussed on more detail in section 5.

3.19 Figure 15 of GSD (extracted from Figure 5 of the Camden Core Strategy) indicates that Kings Mews did not flood in either in 1975 or 2002 flood events.

Site History

3.20 Ref 1 and 2 and other data held within [Ref 9] indicate that the site was originally developed at some time between 1682 and 1720. A possible drainage ditch was noted on a plan dated 1720 at a location around 100m to the north. However this was backfilled by 1747.

3.21 More recent information relating to the site history has been obtained by reference to historic maps contained with [Ref 1], [Ref 3] and [Ref 9], including plans at 1:1000, 1:1250, 1:2500 and 1:10, 000 scale and dated 1875 through to 2006. In the context of this screening and scoping BIA this data is summarised for the site and a 100m buffer zone in Table 3.3.

TABLE 3.3: SITE HISTORY

Date	Development
1875	The site is occupied by a series of buildings, considered likely to be of residential usage. The surrounding area is also indicated to be generally of residential nature. However, the grounds to Gray's Inn are located 60m to the south and a brewery is located 130m to the east.
1878-1896	No significant change
1916	The brewery had been removed and replaced by a series of buildings, presumably residential or possibly offices.
1920-1938	No significant change
1952-1954	No significant change, although some ruins are noted in the areas around the site – the nearest being approximately 55m to the southwest. A building on Gray's Inn Road is absent
1957	No 26 Kings Mews is also indicated to be absent.
1960-1968	No significant change
1974	No 23 Kings Mews is shown as being connected to 49 Grays Inn Road. Also, No 26 has been reconstructed..
1991 – 2006	No significant change

3.22 Bomb Damage Maps [Ref 11] indicate that the site is an area that received wartime damage, including 'damage beyond repair' being recorded in relation to No 43 Gray's Inn Road and in relation to buildings the opposite side of Kings Mews

3.23 Aside from the historic irrigation feature discussed above, the plans consulted did not indicate any historic water courses, ponds or wells within 100m of the site.

Liaison With Regulatory Authorities

3.24 At the current time liaison with the London Borough of Camden has not been implemented. It is a recommendation of this report that this report be submitted (pre-planning if possible) to form agreement on the matters discussed herein.

4.0 SCREENING

4.1 In accordance with the GSD, an initial screening exercise has been undertaken of Subterranean Flow (Table 4.1) Slope Stability (Table 4.2) and Surface Flow and Flooding (Table 4.3). These tables follow the form of the BIA Screening flowcharts which are presented in Appendix E of the GSD.

TABLE 4.1: SUBTERRANEAN (GROUNDWATER) FLOW

No.	Question	Answer	Justification
1a	Is the site located directly above an aquifer?	Yes	Site is underlain by Made Ground over River Terrace Deposits. See section 3.
1b	Will the proposed basement extend beneath the water table surface?	Yes	Anticipated groundwater level of 3.60m bgl (see section 3) vs. proposed basement level of up to 4.10m bgl.
2	Is the site within 100m of a watercourse, well (used/disused) or potential spring line.	No	No such features recorded within 100m of the site on Figures 2, 11, 12 of the GSD, aerial photography (Google Earth), ordnance survey maps (section 2 and 3), geological information (see section 3), Environment Agency website (see section 3) or Ref [10]. Nor were such features noted during the site reconnaissance (See section 2).
3	Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is not located within the areas indicated on Figure 14 of the GSD.
4	Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	No	Site visit (section 2) confirmed that the area of the proposed basement is already covered with hardstanding.
5	As part of the site drainage will more surface water (e.g. Rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and / or SUDS)?	No	The extent of the basement in combination with its depth relative to groundwater level means that the development is not amenable to soakaway drainage. The existing site is covered with hardstanding as will the proposed development; volume and peak will not be materially changed.
6	Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or	No	No ponds or spring lines recorded within 100m of the site.

	spring line?		

TABLE 4.2: SLOPE STABILITY

No	Question	Answer	Justification
1	Does the existing site include slopes, natural or manmade, greater than 7°?	No	Site reconnaissance [Section 2] and ordnance survey maps [Section 4] confirm that the site is essentially flat. Figure 16 of the GSD indicates that the site is not in an area where the slope angle exceeds 7°.
2	Will the proposed re-profiling of the landscape at the site changes slopes at the property boundary to more than 7°?	No	The current plans detailed in Appendix A do not indicate landscape reprofiling.
3	Does the development neighbour land, including railway cuttings and the like, that slope greater than 7°?	No	Site reconissence [Section 2] and ordnance survey maps confirm that site does not neighbour such features. Figure 16 of the GSD indicates that the site is not adjacent to an area where the slope angle exceeds 7°.
4	Is the site in a wider hillside setting with a slope of more than 7°?	No	Site reconnaissance, ordnance survey data and Figure 10 of the GSD indicated the area around the site has a modest gradient of around 1.5° to the north. Figure 16 of the GSD indicates that the site is not in an area where the slope angle exceeds 7°.
5	Is the London Clay the shallowest strata at the site?	No	Site geology as discussed in Section 3.
6	Will any tree(s) be felled as part of the proposed development and/or any works proposed within any tree protection zones where trees are to be retained?	No	Site visit confirmed no trees on or directly adjacent to site.
7	Is there a history of shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	No	The London Clay is overlain by water bearing River Terrace Gravels and the site is remote from trees. Such a setting is not conducive to shrink-swell subsidence.
8	Is the site within 100m of a watercourse or potential spring line?	No	See answer to Q2 of Table 4.1
9	Is the site in an area of previously worked ground?	Yes	Given the site history (Section 4) and the geological data consulted (Section 3) Made Ground is anticipated to depths of 4.5m bgl.
10	Is the site within an aquifer? If so, will the proposed basement extend beneath the	Possibly	The basement excavation is anticipated to be up to 4.55m bgl which, depending on

	water table such that dewatering may be required during construction?		seasonal factors could be around 1m below the anticipated groundwater level. Some form of groundwater control is therefore anticipated, which may include some form of water abstraction.
11	Is the site within 50m of the Hampstead Ponds?	No	Figure 14 of the GSD indicates that site is considerable greater than 50m from the Hempstead Ponds.
12	Is the site within 5m of a highway or pedestrian right of way?	Yes	The site walkover (Section 2) and ordnance survey maps (Section 4) indicate that the site is adjacent to Kings Mews road.
13	Will the proposed basement significantly increase the differential depth of the foundations relative to neighbouring properties?	Yes	The existing party wall foundations are understood to be in the region of 1.25 to 2.00m bgl (see Section 2) whereas the proposed basement excavation will extend to 4.55m bgl. Whilst some cracking was noted to the western building elevation during the site walkover (as discussed in S
14	Is the site over (or within the exclusion zone of) any tunnels?	Possibly	As discussed in Table 3.1, the site is in the vicinity of the old mid-level sewer.

TABLE 4.3: SURFACE FLOW AND FLOODING

No	Question	Answer	Justification
1	Is the site within the catchment of the ponds on Hampstead Heath?	No	See answer to Q3 of Table 4.1
2	As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	The existing site is covered with hardstanding as will the proposed development; volume and peak will not be materially changed.
3	Will the proposed basement development result in a change in the proportion of hard surfaced/paved external areas?	No	See answer to Q4 of Table 4.1
4	Will the proposed basement result in changes to the profile of the inflows (instantaneous and long term) of surface water being received by adjacent properties or downstream water courses?	No	The status quo will be maintained: the existing site is covered with hardstanding as will the proposed development. The site is remote from watercourses
5	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream water courses?	No	The status quo will be maintained: the existing site is covered with hardstanding as will the proposed development. The site is remote from watercourses.
6	Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water features?	No	The site is not in an area of known surface water flood risk (see Section 3). The site is remote from water features: see response to Q2 in Table 4.1.

5.0 SCOPING

5.1 This scoping study incorporates a site walkover, desk study data and ground investigation data as discussed in sections 2 and 3 of this report. It considers the findings of the screening exercise presented in section 4 where either 'yes' or 'unknown' or 'possibly' responses have flagged a potential issue.

Ground Model

5.2 The anticipated ground conditions are presented in Table 3.1. An equilibrium groundwater level of around 3.60m bgl is anticipated in the River Terrace Gravel aquifer. The planned basement excavation formation level is anticipated to be around 4.55m bgl. The surrounding party walls are founded at depths of around 1.25 to 2.00mbgl. The road pavement to Kings Mews is directly adjacent to the west of site. The site is in proximity of a sewer.

Potential Impacts and Possible Control Measures

5.3 With due consideration of the ground model, the potential impacts in relation to the matters requiring further consideration from the screening stage are discussed in Tables 5.2 and 5.3 below. For each matter discussed the potential impact is defined in terms of significance based on EIA terminology as defined in Table 5.1 below. Tables 5.2 and 5.3 also consider the potential residual significance assuming the suggested mitigation measures are taken forward. For each potential impact a comment is presented on the pertinent matters and a concluding discussion is presented in Section 6.0.

TABLE 5.1: SIGNIFICANCE MATRIX USED WITHIN THE ASSESSMENT

MAGNITUDE OF EFFECT	SENSITIVITY OF RECEPTOR				
	Very high	High	Medium	Low	Negligible
Very large	Substantial Significance	Substantial Significance	Moderate Significance	Moderate Significance	[1]
Large	Substantial Significance	Moderate Significance	Moderate Significance	Minor Significance	[2]
Medium	Moderate Significance	Moderate Significant	Minor Significance	[2]	Neutral Significance
Small	Moderate Significance	Minor Significance	[2]	Neutral Significance	Neutral Significance
Negligible	[1]	[2]	Neutral Significance	Neutral Significance	Neutral Significance
[1] The choice between '*Moderate Significance*', '*Minor Significance*' and *'Neutral Significance' will* depend on the specifics of the impact and will be down to professional judgement and reasoning.					
[2] The choice between '*Minor Significance*' and '*Neutral Significance*' will depend on the specifics of the impact and will be down to professional judgement and reasoning.					

TABLE 5.2: SUBTERRANEAN (GROUNDWATER) FLOW. POTENTIAL IMPACTS

No	Question	Potential Impact
1	Is the site located directly above an aquifer?	A possible increase in groundwater level may be experienced behind the western elevation and possible reduction may be experienced in front of the eastern elevation. Such matters are assessed below and are considered to be of minor significance, subject to suitable detailed design and construction monitoring. Whilst the site is indicated to be in an area of 'moderate to high susceptibly' to groundwater flooding, the impact on the associated risk is considered to be limited, given: the depth of the groundwater; that the basement is of limited plan area; and, given the discussion below, of a negligible effect anticipated on the status quo conditions. **Given the above such matters are considered to be of minor significance.** The presence of groundwater may need to be considered in the design of the basement and the foundations. This is discussed separately below.
	Will the proposed basement extend beneath the water table surface?	

5.4 Construction of the basement will extend below the water table. Consequently construction of the basement may result in a reduction in the groundwater level down hydraulic gradient. The extent of this (the nature of the area affected) will depend in a number of factors, such as the pre-existing hydraulic gradient, the groundwater flow direction (anticipated to be the north east), the extent of existing basements (whilst these are prevalent in the area, especially along Grey Inn Road, it is currently unclear to what degree these also extend to below the water table) and the degree to which the basement construction will interrupt or cut off the groundwater flow as discussed below.

5.5 A planned excavation depth of 4.55m bgl is anticipated. This is around 1m below the anticipated groundwater level and will involve excavation through soils that are likely to have relatively high permeability. This is a practical issue with respect to forming the excavation and the underpinning of adjacent properties and this is discussed in more below in relation to Table 5.3.

5.6 Dependent on the method of construction, in the permanent case the basement will either (i) extend below the water table surface, but not cut off the groundwater flow (if temporary dewatering is undertaken), (ii) locally reduce the permeability of the River Terrace Deposits (if permeation grouting is adopted) or (iii) locally cut of the groundwater flow (if a piled wall solution is adopted).

5.7 Based on a worst case reduction of 4.60m bgl and assuming that the Made Ground has a modulus of around 4000kN/m^2 ('Old Urban Fill', Table 3.1 Foundation Design and Construction, Tomlinson, 5th Edition), then settlement of around 5mm could occur immediately adjacent to the downstream elevation. The magnitude of this settlement would decrease with increasing distance from the basement. In isolation the magnitude of movement is unlikely to result significant strains in surrounding structures, but this would need to be considered in combination with other sources of ground movement associated with the basement construction at detailed design stage.

5.8 Similarly a modest increase in the water table may be experienced up hydraulic gradient. The nature of this will also depend on the factors given the above. Given the depth of the groundwater table (3.60m bgl) it is unlikely that this would be associated with a risk of flooding at ground level. This possible modest increase in groundwater level is unlikely to affect surrounding basements given the depth of the groundwater table, the relatively permeable nature of the River Terrace Deposits and the distance up hydraulic gradient of the nearest recorded basement (19m to a possible half height basement at No 10 Kings Mews)

5.9 The basement should be designed to address hydrostatic pressures as required in BS8102 'Protection of Structures against Water from the Ground'. It should be noted that the basement walls will act as retaining walls and these will need to designed to accommodate soil pressures and hydrostatic pressures.

TABLE 5.3: SLOPE STABILITY: POTENTIAL IMPACTS

No	Question	Potential Impact
9	Is the site in an area of previously worked ground?	Such ground has a relatively poor load bearing and settlement characteristics, which lead to a risk of structural failure or adverse differential movement. **This matter is of substantial significance**. This potential impact can be addressed by utilising the underlying River Terrace Deposits as a founding stratum or by utilising piled foundations. Subject to such operations this matter is reduced to **minor significance**. Such materials are likely to require temporary support during excavation. The depth of such materials is to be confirmed through site specific ground investigation.
10	Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	It is recommended that a site specific ground investigation is undertaken. A planned excavation depth of 4.55m bgl is anticipated. This is around 1m below the anticipated groundwater level and will involve excavation through soils that are likely to have relatively high permeability. Therefore some form of dewatering or groundwater control will be required during construction. Such matters would need due consideration by the temporary works engineer or could be incorporated in the permanent works. Such matters are discussed in more detailed below. Subject to the application the adoption of suitable engineering measures and monitoring works as outlined below, this matter is considered to be of residual **minor significance**.
12	Is the site within 5m of a highway or pedestrian right of way?	Basement construction could result in ground movements detrimental to the highway and any infrastructure contained therein. Statutory undertakers should be

		consulted so as establish if any buried utilities are present and the owners of these assets, along with the owner of highway, so as to determine any constraints to design, for example, easements, surcharge loadings on the basement walls and limiting values on ground movement. This matter is considered to be of substantial significance. Such matters will need to be modelled in the design of the basement. They are likely to result in a need for support to the excavation, through either bored piling or temporary sheet piling and may require the excavation to be propped. On such a basis the residual risk is considered to be of **minor significance.**
13	Will the proposed basement significantly increase the differential depth of the foundations relative to neighbouring properties?	The basement excavation will act to undermine the adjacent foundations leading to a risk of movement and damage. **This matter is considered to be of substantial significance.** Underpinning of these foundations is therefore recommended. The extent and nature of the underpinning would need to consider the potential for differential movement between the new, stiffer, foundations and the parts of the buildings on original foundations. Conventional underpinning would need to be undertaken in an appropriate and controlled 'hit and miss' sequence to minimise the risk of movement. As discussed in item 10, the temporary works engineer may need to consider the presence of groundwater above the bearing stratum, which may result in the conventional underpinning not being the preferred solution, possibly necessitating a piled underpinning solution. Alternatively, if a piled basement wall is taken forward, consideration could be given to ground modelling to determine if the adjacent foundations could be left as they are, but the with wall designed to accommodate the associated surcharge and to minimise ground movements. Assuming the proposed buildings are to be on foundations independent of the adjacent properties, construction joints should be placed between this building and the adjacent

		structures. In relation to the above matters it is recommended that a pre and post works building and highway condition survey is undertaken in relation to the surrounding buildings and that building movements are monitored during and after the works. The design of the basement and the associated temporary works will need to give the above matters due consideration so as to ensure a minor residual significance.
14	Is the site over (or within the exclusion zone of) any tunnels.	The site is in the general vicinity of a sewer. The proposed development could result in ground movements, such as ground heave associated with stress relief arising from the basement excavation or settlements arising from the new foundations. Similarly the new foundations could result in load being shed on to the sewer. It is recommended that the utilities search discussed above is extended to include operators of underground tunnels. The asset owners should be consulted with regard to confirming the location, depth and nature of their tunnels and to establish any associated constraints to the proposed development. Typically such constraints comprise foundations exclusion zones and limitations on the magnitude of the load shed on to the asset and on the ground movements experienced by the asset. Initial data suggests that the site may be sufficiently remote from such features for such matters to be **of minor significance.**

5.10 Matters associated with item 10 in Table 5.3 are particularly complex and warrant further consideration. As the basement excavation (and associated underpinning) is anticipated to extend around 1m below the groundwater level and involves relatively permeable materials, then either some form of dewatering will be required or consideration given to other forms of groundwater control. Such options are summarised in Table 5.4. Each option has its own merits and residual issues. It is noted that the depth of the London Clay may make it difficult to cut off groundwater using trench sheeting.

TABLE 5.4: GROUNDWATER CONTROL OPTIONS

Option	Principal Discussion Points
Dewatering	Dewatering will result in ground movements although, these are likely to be limited. This option could result in a significant volume of water requiring storage and disposal (which would also have cost implications) and would require an abstraction / discharge license from the EA.
Permeation Grouting	This would act to reduce the permeability of the ground and hence enable control of water by pumping from screen sumps. It would require monitoring and control to prevent ground heave. It may also require consultation with the EA and could result in a local reduction in ground permeability in the longer term, which could have implications for groundwater levels around the site. Such matters are discussed in relation to Table 5.2 above.
Secant Pile Wall	Such piles would need to be taken to a suitable depth so as to toe into the London Clay, cut off the groundwater flow into the basement and hence enable pumping from screened sumps. This could have implications for groundwater levels around the site in the longer term. Such matters are discussed in relation to Table 5.2 above. Consideration would need to be given to the effects of installation and as well as basement excavation, although this could be reduced by the use of a cased CFA. Loss of basement space would need to be considered by the client.
Sheet Pile Wall	Such piles would need to be taken to a suitable depth so as to toe into the London Clay, cut off the groundwater flow into the basement and hence enable pumping from screened sumps. This could have implications for groundwater levels around the site if adopted as part of the permanent works. Such matters are discussed in relation to Table 5.2 above. Consideration would need to be given to the effects of installation and as well as basement excavation , although this could be reduced by the use of a 'silent piling' techniques to push the piles in. It would need early contractor involvement to ensure that the wall can be installed and designed to be load bearing if to be used in the permanent case. Loss of basement space would need to be considered by the client.
Ground Freezing	Expensive, risk of ground heave and other effects on nearby properties would need to be considered.

5.11 Should dewatering be taken forward then the suitable screening of the pumps would be required so as to prevent loss of the fine soil fraction. Assuming this to be the case and assuming (i) a temporary groundwater level of 4.60m bgl is required and (ii) the Made Ground has a modulus of around 4000kN/m^2 ('Old Urban Fill', Table 3.1 Foundation Design and Construction, Tomlinson, 5th Edition), then settlement of around 2mm could occur immediately adjacent to the basement. This would decrease with increasing distance from it. In isolation the magnitude of movement is unlikely to result significant strains in surrounding structures, but this would need to be

considered in combination with other sources of ground movement associated with the basement construction at detailed design stage.

5.12 Whichever option is adopted for the construction of the basement it is recommended that the temporary works are designed as to provide sufficiently stiff support and that surrounding structures and ground are subject to a rigorous programme of monitoring so as to enable suitable control to be applied to the work. Provided that these options are taken forward it should be possible to no worse than 'slight' as defined on Page 14 of CPG4.

5.13 The existing information indicates that the basement requires detailed engineering design, but subject to an appropriate design and construction. The risks identified in tables 5.2 and 5.3 can be addressed by a competent engineering design, soil investigation and construction process.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 The existing information and assessment suggests that, subject to a site specific ground investigation, additional supplementary investigations and detailed design, the proposed basement at 22 Kings Mews should not :

- cause harm to the built and natural environment and local amenity;
- result in flooding; or,
- lead to ground instability.

6.2 For ease of auditing against section 8.1 of the Guidance for Subterranean Development (GSD) key aspects of this report are summarised in Table 6.1 below.

TABLE 6.1: SUMMARY AUDITABLE MATTERS

Issue	Comment
Author credentials	Given Section 1.10
BIA Flowcharts	Used in Section 4.0
Temporary and Permanent Works that may impact geology, hydrogeology and hydrology	Discussed in Section 5.
Investigation of issues associated with impacts on land stability, hydrogeology and hydrology	This scoping and screening report is based on a site walkover and existing ground investigation and desk study data (Section 2 and 3). Potential impacts are identified in section 4 and discussed in Section 5. Recommendations for further work are given below.
Presentation of Maps	See Appendix A
Assessment Methodology	A desk study, based on the requirements of 7.2.1 of the GSD, is presented in Sections 2 and 3 and is considered in sections 4 and 5. Other matters relating to the assessment methodology are discussed in 6.3 below.
Has the need for mitigation been considered and included in the scheme	Possible mitigation measures are discussed in section 5, the extent to which these may be required would depend on the outcome of the proposed ground investigation works.
Has the need for monitoring been addressed and is the proposed monitoring sufficient and adequate.	The need for monitoring is discussed in section 5 Such matters will need to be given due consideration in design development to enable suitable schemes to be

	established.
Residual impacts	As discussed in Section 5 residual impacts are likely to be of only negligible or minor significance.

6.3 This scoping and screening report is based on a site reconnaissance, desk study data and ground investigation data held in the CampbellReith GIS database. It is recommended that the Client commissions his own ground investigation at the site to confirm the ground conditions and groundwater regime. The investigation should comply with sections 7.2.2 and 7.2.3 of the GSD. The need and extent of any monitoring and the presentation of calculations are matters that must be addressed through design development.

6.4 The Client also has access to a ground investigation report for the site and adjacent site, including cable tool boreholes, trial pits, geotechnical laboratory testing and post site groundwater level monitoring arising from this investigation. For such data to be used in design it is recommended that the client obtains a warranty for it.

6.5 The client will be required to seek party wall awards for the proposed works which comply with current legislation.

Further Site Investigation and Study:

6.6 To address the potential impacts discussed in Section 5 the following further investigations are recommended in due course:

- The Client commissions a site specific ground investigation;
- The Client obtain warranties for the data listed in Table 1.1;
- If still serviceable and subject to agreement with No 25, it would be prudent to utilise the existing borehole installations to undertake additional groundwater level monitoring
- The Client undertakes consultation with local residents to establish local concerns;
- Through such consultation and through consultation with the local authority, enable a better understanding of the extent of neighbouring and nearby basements;
- Statutory undertakers, including utility operators and the owners of underground tunnels, are to be consulted to establish if any such assets could be affected by the works and associated constraints; and
- The owner of the adjacent road pavement (likely to be the London Borough of Camden) is consulted to establish associated constraints.

6.7 In terms of ground investigation works, this could be minimised by obtaining warranties in relation to existing ground investigation reports as discussed above. Subject to this the main issues to be considered are; establishing the depth a suitable founding stratum (granular River Terrace Deposits) and the depth to groundwater. Existing information indicates that these two elements can be quite variable locally and, in the case of the later, can vary with time.

6.8 It is understood that No 22 will be redeveloped at the same time as No 23 and No 24 King's Mews. Given the nature of the existing data, the prevailing access constraints and the modest nature of the whole of the development in the first instance consideration could be given to 3No continuous dynamic sample holes (windowless sample holes), augmented with dynamic probing and 'drive-in' piezometers and, if possible, some monitoring of the borehole on the adjacent site.

6.9 Depending on the outcome of the consultations discussed above there may be the need to better understand groundwater flow through additional ground investigation works,

Other Actions

6.10 In addition following actions should be considered:

- It should be established if the site's building frame extends into the adjacent properties.
- a pre and post works condition survey should be undertaken in relation to potentially affected surrounding properties (in relation to this the cracking on the side of the walls to the northwest and northeast of No 22, although removal of the plaster for detailed inspection by a structural engineer may confirm these to be trivial).
- modelling of ground movements would be required.
- modelling of ground movements and ground stresses may also be required in relation to buried tunnels although, on the basis of existing data, this is less likely.
- monitoring of ground and building movements will be required, depending on the form of basement construction, the foundation solution adopted and any underpinning; and,
- as the extent and the depth of the basement relative to the groundwater level are such that the development is unlikely to be amenable to soakaway drainage, the client will need to consult with Thames Water with respect to disposal of such water through the mains network.

Preliminary Design Guidance

6.11 As the design of the basement is taken forward the matters outlined in Tables 5.2 and 5.3 will need further consideration in terms of the Impact Assessment and Review and Decision Making stages of the BIA. Given below are some outline design guidance based on the existing data:

- If, through site specific ground investigation, the groundwater table is above the depth of a suitable founding strata for conventional underpinning, a piled foundation and basement solution is likely to be the most practicable
- a piled basement wall could be designed with sufficient propping to support the adjacent foundations and road pavement.
- it should be noted that a piled solution is likely to result in a reduction of usable space within the final basement when compared to that possibly achievable using conventional underpinning. It this is unacceptable to the client, then consideration could be given to a solution involving groundwater control measures and measures to support the associated excavations, founding the proposed building and the underpinning on the River Terrace Deposits and temporary sheet piling of the western part of the excavation (to support the adjacent road). In relation to this option possible groundwater control options include dewatering and grouting. These carry a risk of ground movement, which would need to be modelled, and other risks that would need to be considered.
- underpinning, piling and groundwater control measures are all specialist operations and so it is recommended that specialist contractors are consulted at an early stage so as to establish the viability of their proprietary techniques given the prevailing ground and groundwater conditions and the access constraints that will apply at the time of construction.
- the client should employ a chartered engineer with respect to the design of the basement, the foundations and the underpinning.
- it is recommended that any piling operations are undertaken by firms that are members of the Federation of Piling Specialists and any underpinning is undertaken by firms that are members of the Association of Specialist Underpinning Contractors.
- given the setting of the site it is recommended that consideration should be given to the potential risks to any below ground works, including any further intrusive ground investigation works, posed by UXOs in accordance with CIRIA Report C681. In the first instance this should be informed by a Preliminary Risk Assessment undertaken in accordance with that document.
- the excavation of the basement will result in a volume of waste soil arising, and possibly also groundwater, which should be classified and disposed of in accordance with good practice and legislation.

Appendix

TECHNICAL REFERENCES

No *	Reference Title	Type	Section
5	British Geological Survey. North London. England and Wales Sheet 256. Solid and Drift Edition.	Map	3
6	The Engineering Implications of Rising Groundwater Levels in the Deep Aquifer Beneath London. CIRIA Report SP69	Technical Report	3
7	Historic London Geological Map. London Sheet nV.S.W. dated 1920. 1:10560 scale	Geological Map	3
8	Late Quaternary Scour-Hollows and Related Features in Central London. F. G. Berry. Q. Jl Engng Geol. 1979 Vol 12 p9-29	Academic Paper	3
9	CampbellReith GIS Database	Database	3
10	Lost Rivers of London, NJ Barton	Reference Book	3
11	The London County Council Bomb Damage Maps 1939-1945 London Topographical Society 2005.	Reference Book	3

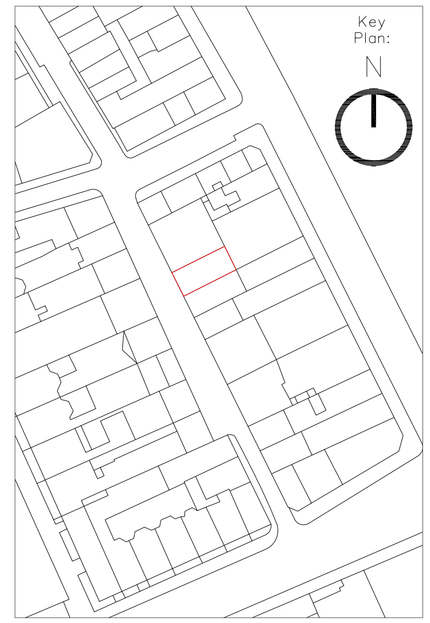
* Note numbering continues from Table 1.1

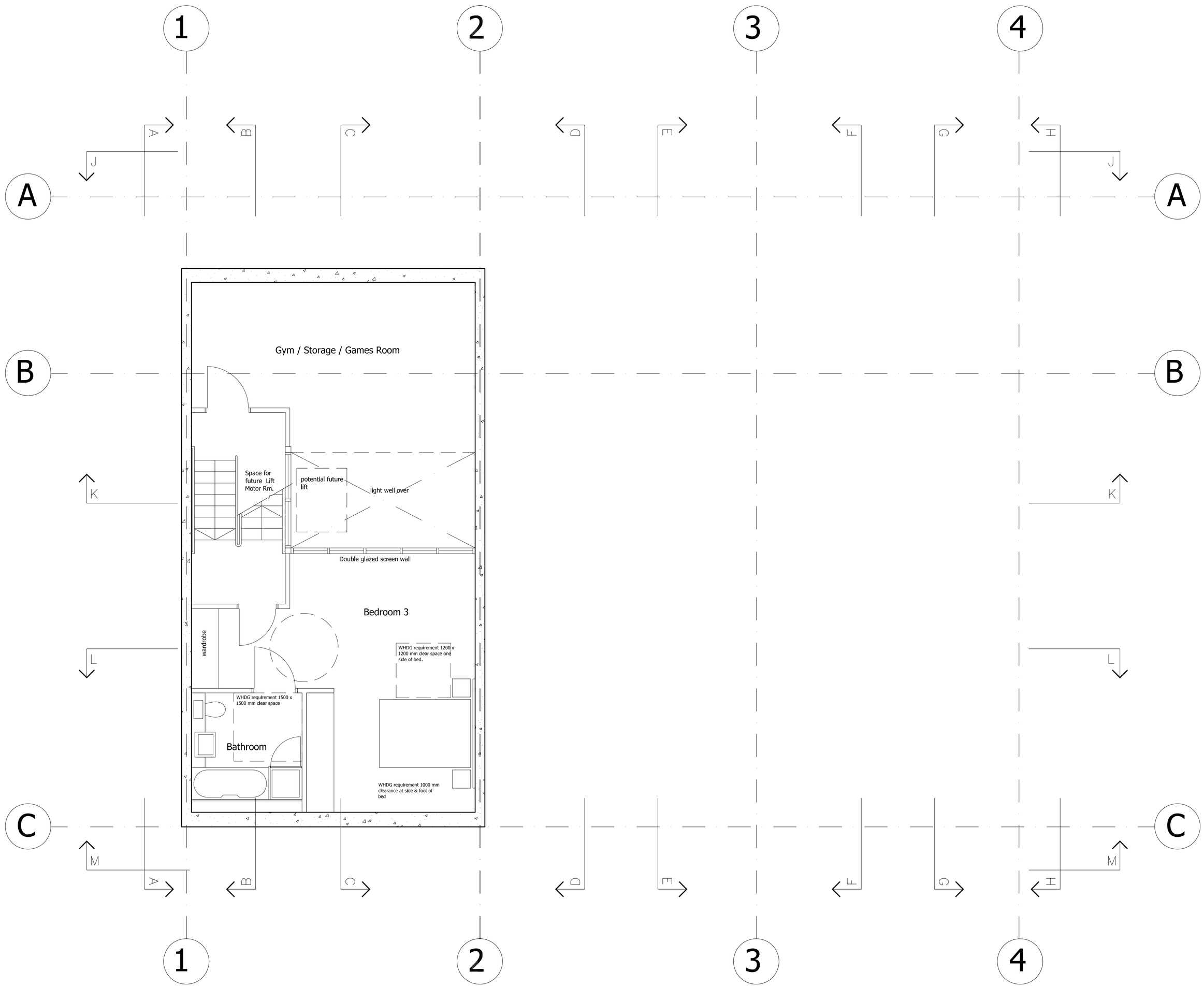
LIMITATIONS

Environmental & Geotechnical Interpretative Reports

1. This report provides available factual data for the site obtained only from the sources described in the text and related to the site on the basis of the location information provided by the client.
2. Where any data or information supplied by the client or other external source, including that from previous studies, has been used, it has been assumed that the information is correct. No responsibility can be accepted by CampbellReith for inaccuracies within this data or information. In relation to historic maps the accuracy of maps cannot be guaranteed and it should be recognized that different conditions on site may have existed between and subsequent to the various map surveys.
3. This report is limited to those aspects of historical land use and enquiries related to environmental matters reported on and no liability is accepted for any other aspects. The opinions expressed cannot be absolute due to the limit of time and resources implicit within the agreed brief and the possibility of unrecorded previous uses of the site and adjacent land.
4. The material encountered and samples obtained during on-site investigations represent only a small proportion of the materials present on the site. There may be other conditions prevailing at the site which have not been revealed and which have therefore not been taken into account in this report. These risks can be minimised and reduced by additional investigations. If significant variations become evident, additional specialist advice should be sought to assess the implications of these few findings.
5. The generalised soil conditions described in the text are intended to convey trends in subsurface conditions. The boundaries between strata are approximate and have been developed on interpretations of the exploration locations and samples collected.
6. Water level and gas readings have been taken at times and under conditions stated on the exploration logs. It must be noted that fluctuations in the level of groundwater or gas may occur due to a variety of factors which may differ from those prevailing at the time the measurements were taken.
7. Please note that CampbellReith cannot accept any liability for observations or opinions expressed regarding the absence or presence of asbestos or on any product or waste that may contain asbestos. We recommend that an asbestos specialist, with appropriate professional indemnity insurance, is employed directly by the client in every case where asbestos may be present on the site or within the buildings or installations. Any comments made in this report with respect to asbestos, or asbestos containing materials, are only included to assist the client with the initial appraisal of the project and should not be relied upon in any way.
8. The findings and opinions expressed are relevant to those dates of the reported site work and should not be relied upon to represent conditions at substantially later dates.
9. This report is produced solely for the benefit of the client, and no liability is accepted for any reliance placed upon it by any other party unless specifically agreed in writing.

APPENDIX A: SITE LOCATION AND DEVELOPMENT PROPOSALS





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Rev	Description	Date	By
-	-	-	-

Status
Preliminary

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Title
Plan Level B
Proposed

Scale
1:50@A1

Date
14/08/2014

Drawn	Checked	
SLW	MH	

Project No	Drawing No	REV
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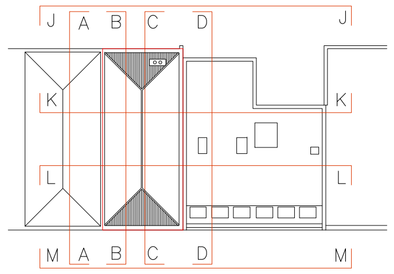

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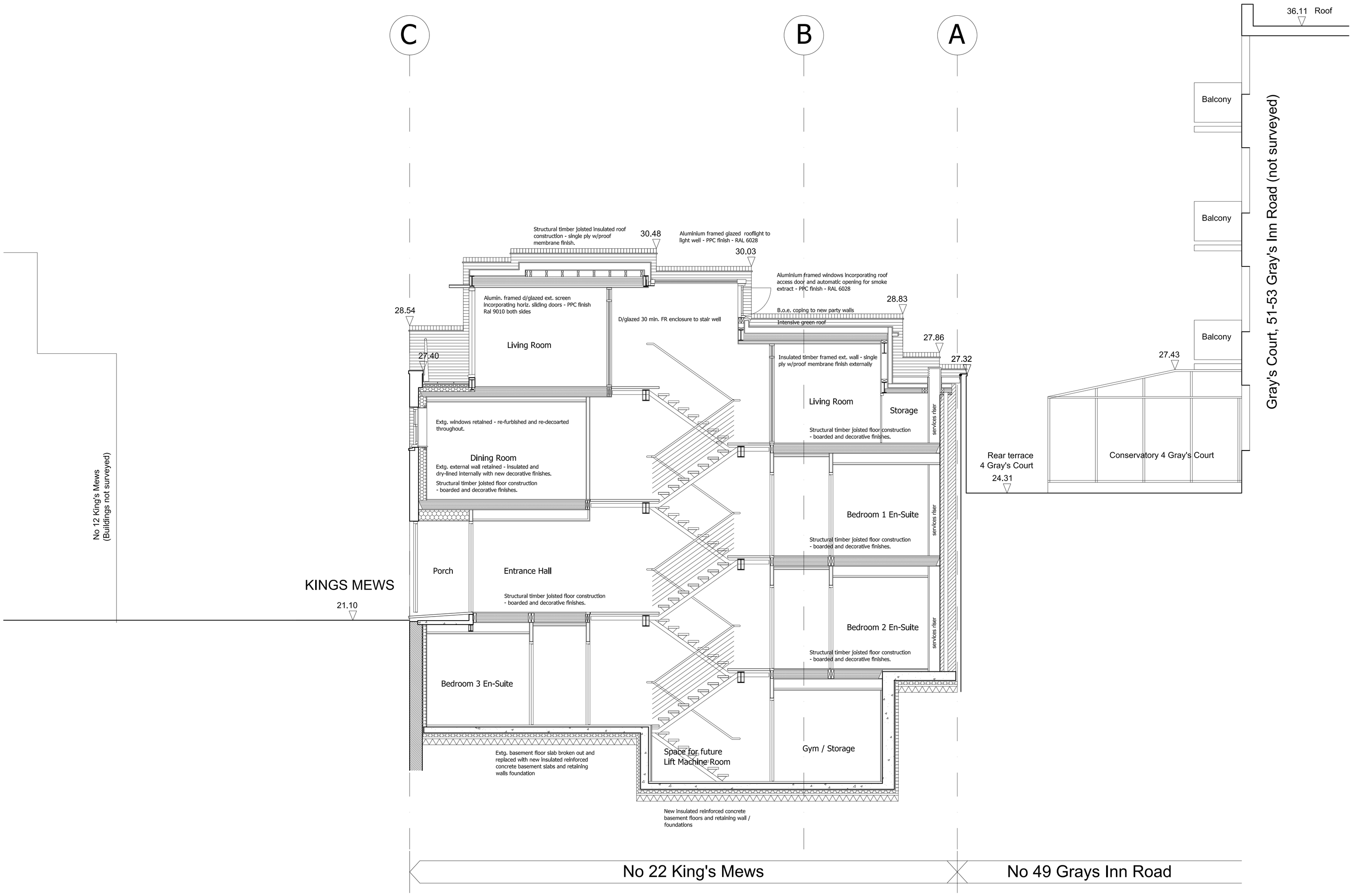

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Status
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Section B-B
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1:50 @A1

Date
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Drawn
SLW

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Project No
0645

Drawing No
L(--) 107

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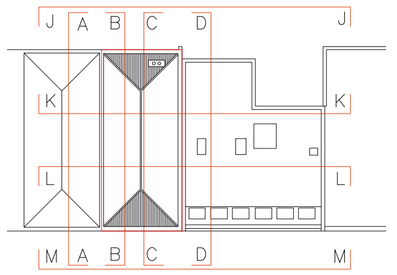

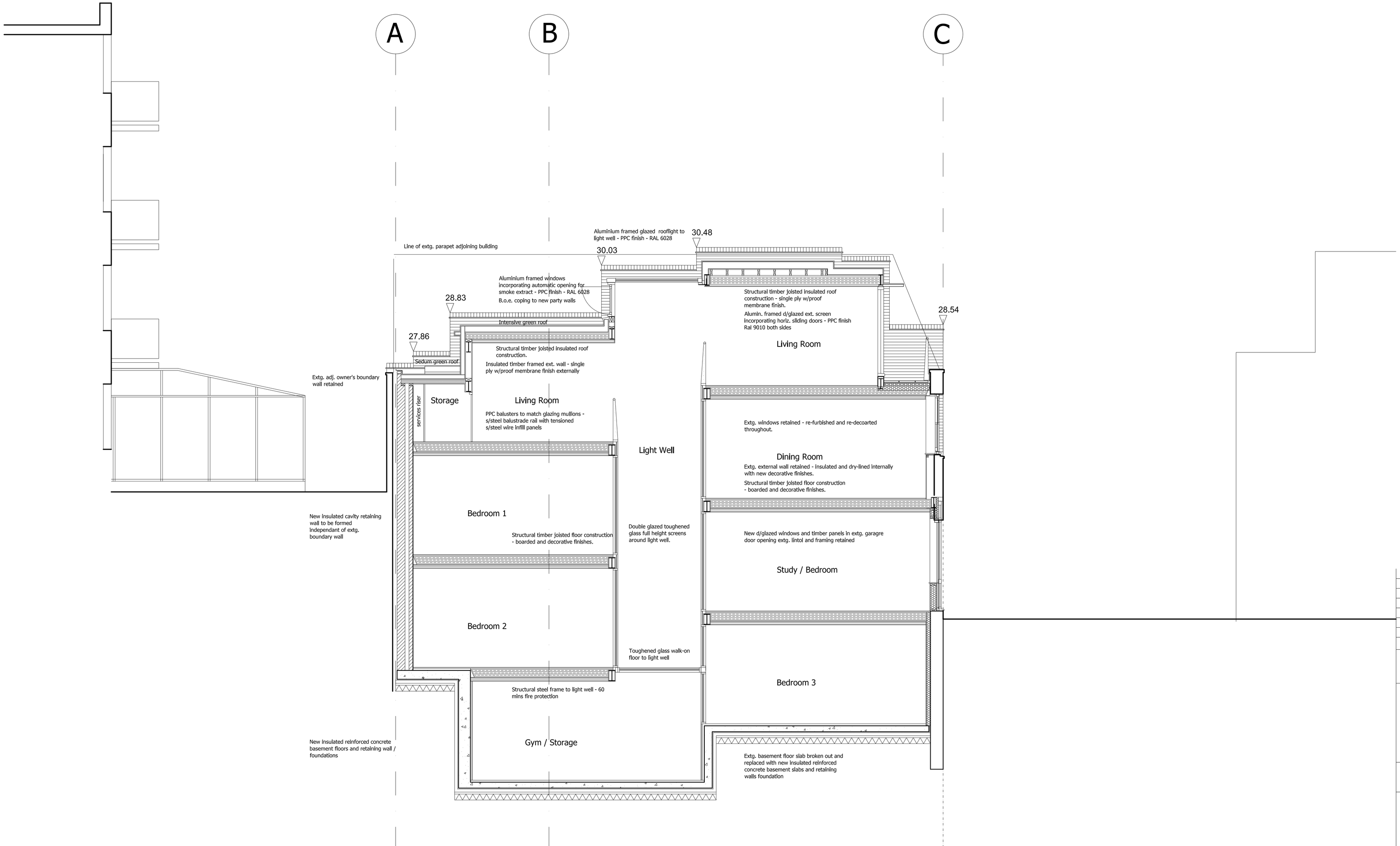

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-	-	-	-

Status
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Section C-C
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1:50 @A1

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Drawn
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Project No
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Drawing No
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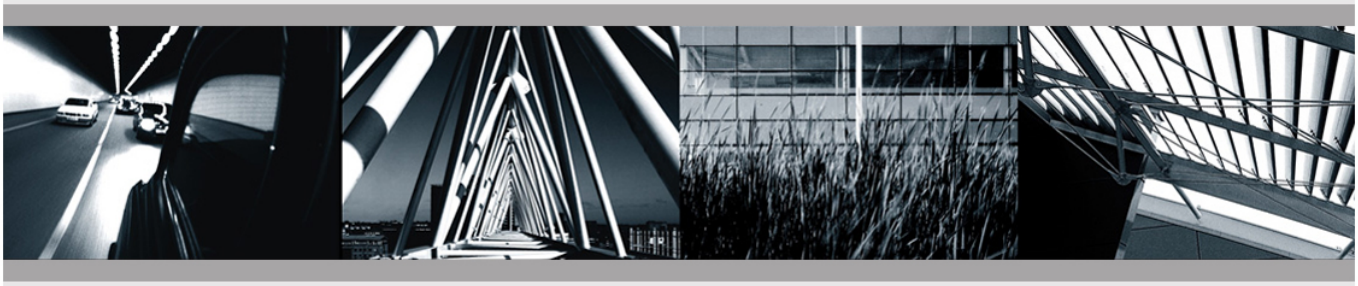

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