APPENDIX B

Drainage Strategy Report

J2680 317 Finchley Road, London

Planning Portal Reference – XX-XXXXXXX

Ref: J680-Doc-02
Revision: X1

Webb Yates Engineers Ltd
44-46 Scrutton Street
London. EC2A 4HH
020 3696 1550
info@webbyates.co.uk
www.webbyates.co.uk

CONTENTS

GENERAL NOTES

Only construction status documentation is to be constructed from. If you do not have a construction issue document and you are about to build something, please contact Webb Yates Engineers. Ensure that you have the latest revision prior to construction.

This document is strictly confidential to our client, or their other professional advisors to the specific purpose to which it refers. No responsibility whatsoever is accepted to any third parties for the whole or part of its contents. This document has been prepared for our client and does not entitle any third party to the benefit of the contents herein.

REVISION HISTORY

Revisions indicated with line in margin.

Revision status: P = Preliminary, T = Tender, C = Construction, X = For Information

Revision	Status	Date	Author	Reviewer	Approved	Description
X1	Information	16/03/16	MJ	GP-D		Issued for Information

1 INTRODUCTION

Webb Yates Engineers have been appointed by Linea Homes to undertake civil and structural engineering design services for the proposed redevelopment at 317 Finchley Road. The mixed used development will provide an 8 storey building comprising of 22 apartments and a new retail space. This drainage strategy report has been prepared on behalf of Linea Homes in respect to this development.

The purpose of this report is to consider the various drainage strategy options and determine the preferred option for the new development.

The site is bounded by; the A41 Finchley Road to the North East; Billy Fury Way, a pedestrian passageway, to the South; and Finchley Road & Frognal railway station, which lies on the London Overground, to the North West.

This document has been prepared with reference to:

- London Borough of Camden Strategic Flood Risk Assessment (SFRA) July 2014.
- Camden Core Strategy November 2010
- National Planning Policy Framework (NPPF) March 2012.
- Sewers for Adoption 7th Edition (October 2012)
- Environment Agency Flood Maps (http://maps.environment-agency.gov.uk/)
- Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems April 2015.
- The London Plan (www.london.gov.uk) 2011.
- The London Supplementary Planning Guidance (SPG) – Sustainable Design and Construction (www.london.gov.uk) 2014.
- SuDS Manual, Ciria 2015.
- Rainfall Runnoff Management for Developments Report – SC030219, Environment Agency 2013

2 SITE DESCRIPTORS

317 Finchley Road's approximate National Grid reference is TQ 26935 85230. Located in North West London, within the Borough of Camden, the site is situated between Hampstead Village to the North East and West Hampstead in the South West. The site's postal code is NW3 6EP and covers an area of roughly 677m^2.

The site is bounded to the North East by the A41, Finchley Road; the A41 links London to Birckenhead. To the South Billy Fury Way, a pedestrian passageway, bounds the site and runs from Finchley Road to West End Lane (B510) and Lithos Road. To the North West the North London Line serving the London Overground bounds the site. Finchley Road & Frognal railway station is found directly adjacent to the site. Traveling East on the London Overground Stratford can be reached whilst Willesden Junction, Clapham Junction and Richmond can be found to travelling West.

The existing site is currently occupied by a former public house fronting Finchley Road, with a beer garden to the rear. The existing building is currently unoccupied and has remained vacant since 2010. The only access to the site is from Finchley Road to the front.

Figure 1: Map of Local Area with site marked with arrow.

Figure 2: Finchley Road Street View

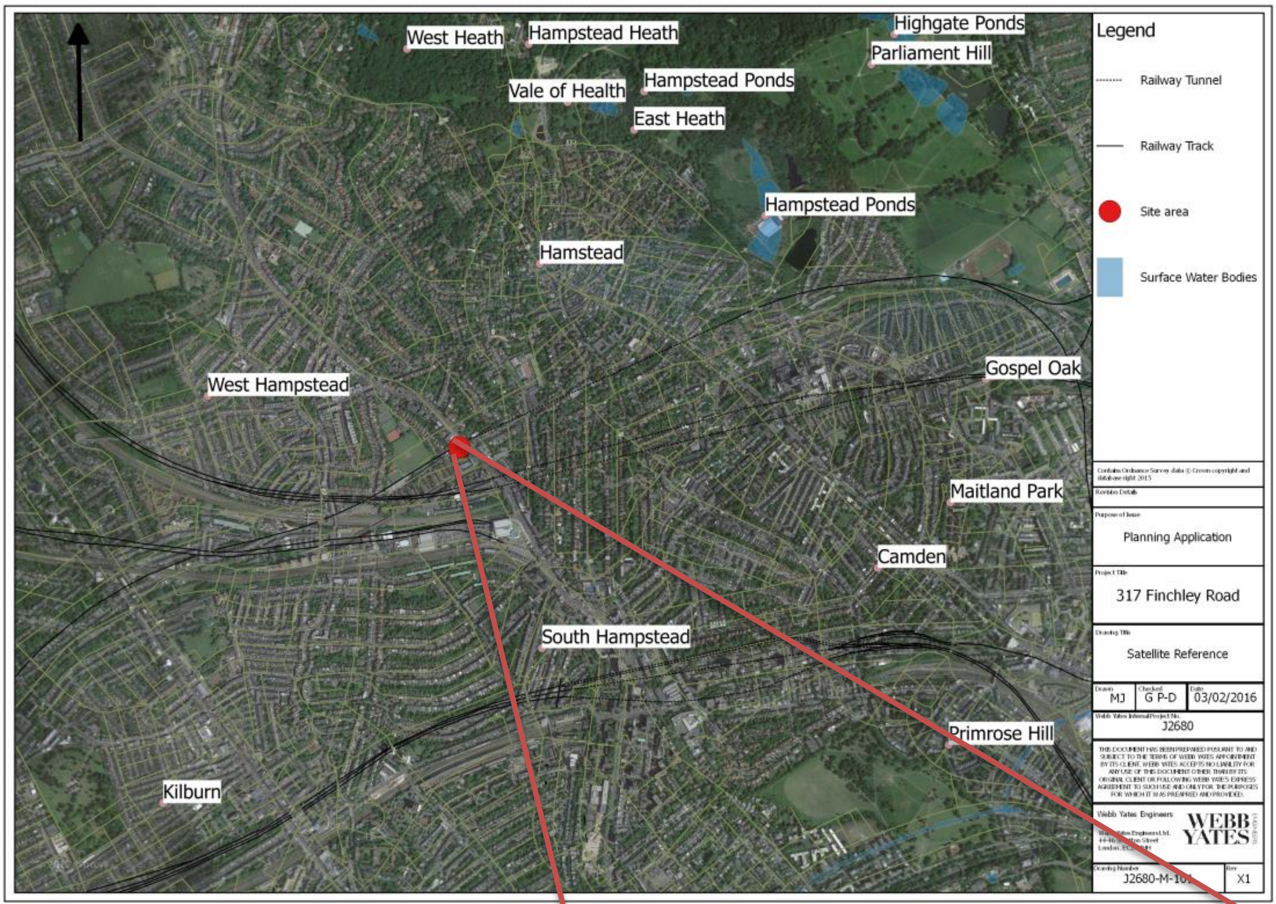

Figure 3: Satellite view of local area; site boundary outline marked in red.

3 SITE CONTEXT

3.1 TOPOGRAPHY

The site topography is sloped from East to West in the downward direction. The highest topographic point, on site, is found on Finchley Road at 60.68mAOD. The lowest topographic point is found on the Western tip along Billy Fury Way passageway and is 56.64mAOD. This gives a slope of 1 in 13.

3.2 GEOLOGY

According to British Geological Society data, 317 Finchley Road is situated on London Clay Formation; the most common bedrock geology found within London region. London Clay was formed during the Ypresian Age (Lower Eocene) around 56 – 49 million years ago. Its small particle size distribution means it has a low hydraulic conductivity and hence reduced permeability.

On site investigations identified the lithological description of the London Clay Formation was stiff, closely fissured, brown mottled clay with selenite crystals and in parts relict roots. The London Clay was found within the range of 1.80m and 3.90m Below Ground Level (BGL).

The site showed no Superficial Deposits according to the British Geological Society data. This was confirmed via on site investigations. Made Ground presumed down to the London Clay Formation bedrock, and was in the range of coarse sand and gravel particle size distribution.

3.3 GROUNDWATER

On site investigation identified groundwater in 1 out of 3 boreholes. Standing water was found at 3.60mBGL in the beer garden of the existing property.

3.4 HYDROLOGY

There are no nearby waterbodies which effect the site. The nearest water bodies include the spring ponds found on Hampstead heath and the Grand Union Canal which runs South of the site. The site lies within a Flood Risk Zone 1

3.5 HYDROLOGEOLOGY

The bedrock geology (London Clay Formation) is an aquiclude. An aquiclude is a geological formation that absorbs and holds water but does not allow transmission of water. It is classified by the Environment Agency as "unproductive strata".

3.6 EXISTING SURFACE WATER DRAINAGE

The existing drainage within the local vicinity of the site include a combined sewer for both surface water and foul water.

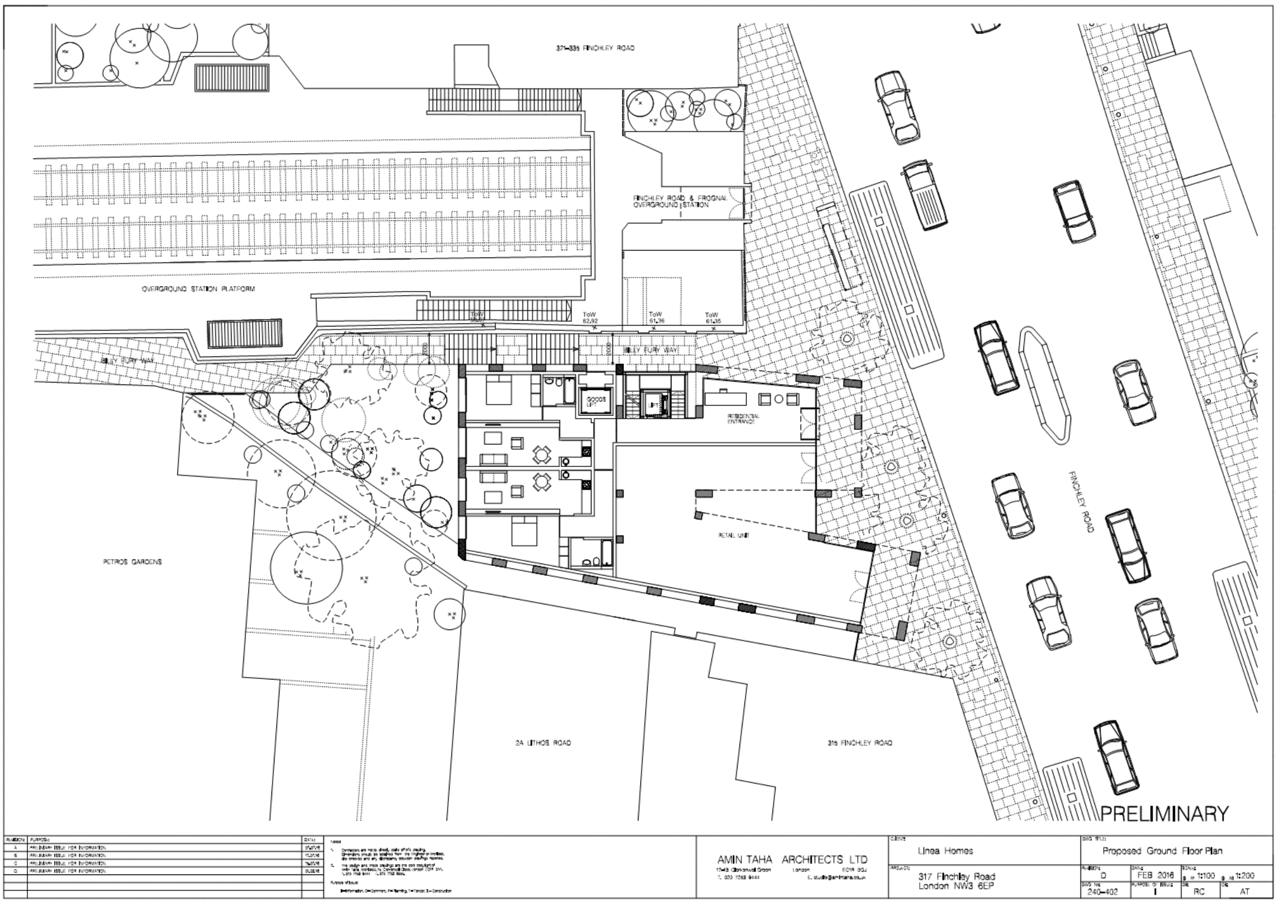

Figure 4: Layout of the proposed development.

4 DESIGN ASSUMPTIONS, CONSTRAINTS AND PARAMETERS

4.1 SPATIAL CONSTRAINTS

Onsite above ground drainage storage options such as swales, ponds and detention basins are not considered a viable solution due to spatial constraints inhibiting for open water features with sufficient capacity.

4.2 CLIMATE CHANGE EFFECTS

In accordance with the National Planning Policy Framework (NPPF) 2010, the effects of climate change are included within the assessment to reduce future flood risk. Following the recommended contingency allowances presented in NPPF, the following allowances should be made for the proposed development:

- **Peak Rainfall Intensity**: +30% for 2085-2115

The new surface water drainage systems for the site will include SUDS and will be designed to accommodate increases in peak rainfall intensity.

4.3 ASSUMED IMPERMEABLE AREAS

The table below identifies the total area of the site and the respective surface areas belonging to hard and soft landscaping.

Table 1: Table of impermeable areas

		Existing Area (m^2)	Proposed Area (m^2)	Difference (m^2)
Hard Landscaping	Building Footprint	311	369	+58
	External h Hardstanding	217	201	-16
	Total	**528**	**570**	**+42**
Soft Landscaping	Total	**149**	**107**	**-42**
Site Area	Total	**677**	**677**	**0**

Although the impermeable area has increased slightly, the amenity and biodiversity area has increased due two terrace roof gardens providing both a social space and vegetation within container gardens.

4.4 INFILTRATION RATES

Borehole investigations taken on site have identified that the site is underlain by made ground which sits on London Clay. Initial infiltration tests carried out on site have shown that the site has a very low infiltration rate due to the high water table and as such soakaways and other infiltration approaches are not likely to be appropriate or sustainable methods to drain surface water runoff from the site.

4.5 HYDROLOGICAL PARAMETERS

The drainage design has assumed the following hydrological parameters found in table 2.

Table 2: Hydrological Parameters

Hydrological Character	Parameter	Unit	Value
Rainfall Model			FSR Rainfall
Hydrological Region		-	6
M5-60		mm	21
Ration	R	R	0.438
Rainfall intensity	M_1 , Z_2	mm , -	12.8 , 0.64
	M_{30} , Z_2	mm , -	30.8 , 1.54
	M_{100} , Z_2	mm , -	40.6 , 2.03
Summer Volumetric Run-off Coefficient	-	-	0.750
Winter Volumetric Run-off Coefficient	-	-	0.840

5 DRAINAGE DESIGN CRITERIA AND PRINCIPLES

5.1 EXISTING DRAINAGE

The existing drainage system for 317 Finchley Road drains into a combined sewer owned by Thames Water. The combined sewer is used to convey both surface water and foul water. The figure below has been adopted from a Thames Water Asset search and identifies the nearby sewage services to the site. The nearest connection manhole is 1002 which has a cover level of 61.45m and an invert level of 55.76m.

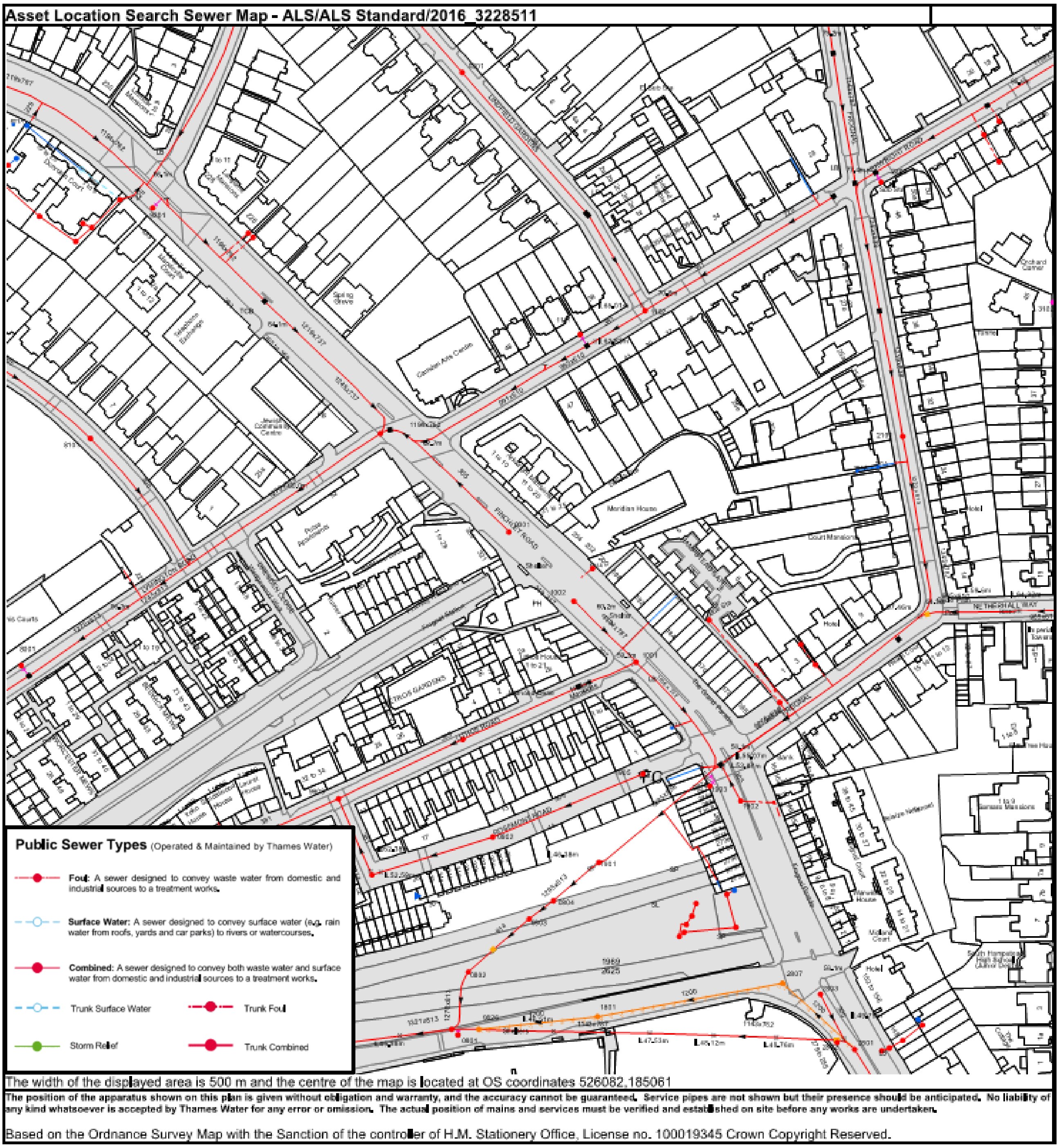

Figure 5: Thames Water Asset Search Map

The existing peak surface water flow draining into the Thames Water system has been calculated to be 12.77 l/s for the 100 year plus 30% climate change. The existing foul water draining into the combined sewer should be minimal as the site has been disused and remained derelict for a number of years.

5.2 PROPOSED DRAINAGE SYSTEM DESIGN

The proposed drainage system will provide separate foul and surface water systems which will confluence at the last manhole on-site within a demarcation chamber before entering the Thames Water Combined Sewer on Finchley Road. This will allow ease to mutually exclude the surface water from the foul system if a separate surface water sewer was to be constructed by Thames Water within the vicinity of the site.

5.3 SURFACE WATER DESIGN

The surface water disposal system has been designed to ensure the drainage hierarchy has been implemented in the most practical and viable approach to benefit to the site; as per the SuDS Manual 2015. Furthermore, the design has considered the Non Statutory Technical standards for sustainable drainage systems, and ensured these standards have been addressed.

Due to the sites topography and the positioning of the Thames Water combined sewer, a pumped surface water system is required. The pump ensures a maximum flow rate of 5l/s for all return periods upto and including the 100 year event plus 30% climate change. This flow rate is as reasonable practicable to the Greenfield runoff rate due to mechanical malfunctions of most flow controls under 5l/s. Furthermore, this flow rate achieves a betterment of greater than 50% of the existing flow rate. Please refer to table 2.

Table 3: Discharge Rates

Return Period	Greenfield Runoff (l/s)	Existing Rates (l/s)	Proposed Unmitigated Rates (l/s)	Proposed Mitigated Rates (l/s)	Difference (l/s) (Proposed Mitigated – Existing)
Greenfield QBAR	0.44	N/A	N/A	N/A	N/A
1 in 1	5	6.89	7.028	5	2.028
1 in 30	5	9.54	9.88	5	4.88
1 in 100	5	10.98	11.43	5	6.43
1 in 100 plus Climate change (30%)	N/A	12.77	13.36	5	8.36

A geocelluar storage unit with a capacity of 20m^3 will be positioned upstream of the pump unit. The geocellular storage unit will have enough capacity to attenuate for the additional volume of water leaving the site upto a 1 in 100 year plus climate change event; as per the London Borough of Camden Drainage Statement pro-forma (table 3).

Table 4: Additional Volumes and Storage Capacities

Return period	Existing Volume (M^3)	Proposed Volume (M^3)	Long term and Attenuation Storage Capacity (M^3)
100 year 6 hour event	8.64	10.05	20

The tower block roofs are designed to provide amenity and biodiversity via the implementation of two roof terrace container gardens. An installation of a rainwater tank to harvest the rainfall runoff from the third, non-vegetated roof could be used to provide recycled water and reduce rainfall runoff volumes. This also increases the interception storage available via evapotranspiration. The design of the current system has not taken this into account and still provides enough storage capacity for the entire site without a rainwater harvesting system installed.

An infiltration based system has not been considered due to the sites geological restrains. Surface water control bodies have not be considered due to the sites spatial limitations.

5.4 FLOOD ROUTING ANAYLSIS

In the unlikely event that the surface water system floods, then this is most likely to occur through a flooding of manhole SPC1.0. The cause of this would be due to rainfall intensity and volume exceeding the pumping flow rate and storage volume within system. Any flood water would be diverted down Billy Fury Way pedestrian footpath due to the topographic levels and funnelling effect of the site and surrounding buildings/structures. This would not cause any detrimental effects to emergency services.

5.5 FOUL WATER DESIGN

It is proposed that the new foul drainage connects to the existing Thames Water combined sewer. The foul water system will provide for 23 residential units and 1 commercial unit within the tower block. Similarly to the surface water system, the foul system will require a pump chamber due to the topography of the site and the positioning of the Thames Water combined sewer.

The foul flowrate has been calculated using the following equation:

$$Q_{ww} = K\sqrt{\sum DU}$$

Where:

Q_{ww} = Foul Water flowrate l/s

K = Frequency factor

$\sum DU$ = Sum of discharge Units

Appliance	Number	DU per appliance	Total
WC	41	2.0	82
Wash Basin	41	0.3	12.3
Bath	23	1.3	29.9
Shower	16	0.4	16.4
Kitchen Sink	23	1.3	29.9
Washing Machine	22	0.6	13.2
Dish Washer	22	0.2	4.4
TOTAL DU			158.2

Therefore based on total discharge unit of 158.2 and a frequency factor of 0.5:

$$Q_{ww} = 0.5\sqrt{\sum 158.2}$$

$$Q_{ww} = 6.29\ l/s$$

A pre-development enquiry with Thames Water will be made to outline the anticipated flow rate.

6 MAINTENANCE

The drainage system will be designed to minimise maintenance requirements, however, a full maintenance scheme will be established for those elements not being offered for adoption. The private storm and foul drains, below ground attenuation tank, and pump chamber will be maintained by Linea Homes to the manufacturer's recommendations as part of their property maintenance program. The downstream public sewer will be maintained by Thames Water as part of their maintenance works.

6.1 BELOW GROUND DRAINAGE PIPED SYSTEMS

The below ground piped system (based on assessed flood risk) should be inspected every 10 years as a minimum and repaired and cleansed where necessary.

6.2 GULLIES AND CHANNEL DRAINS

Gullies and channel drains should be cleaned out very six months or when required.

7 DESIGN STANDARDS AND REFERENCES

The works are to be designed to the requirements of the following British Standards and documents:

- BS EN 752:2008 Drain and Sewer Systems Outside Buildings
- The Wallingford Procedure: Design and Analysis of Urban Storm Drainage
- Building Regulations 2010 Part H: Drainage and Waste Disposal.
- CIRIA Report C697: The SUDS Manual
- National Planning Policy Framework
- Volume 7 of Design Manual for Roads and Bridges.
- BS EN 1997 Eurocode 7- Geotechnical Design of Structures
- Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems April 2015.

8 DRAINAGE DRAWINGS & CALCULATIONS

Refer to Appendix B for the drawings and Appendix C for the calculations.

9 CONCULSION

To conclude the designed proposal is for a pumped, separated surface water and foul system that confluences at the ultimate manhole on site before entering the Thames Water combined sewer found on Finchley Road.

The proposed surface water system will control the flow rate to 5l/s via the pumping chamber. This achieves a betterment of greater than 50% runoff from the existing site and also achieve as reasonable practical the Greenfield runoff rate. A geocelluar storage tank with a capacity of 20m^3 has been implemented upstream of the pump chamber to withhold the attenuation volume and the additional volume subjected from the proposed development. Infiltration methods and surface water body methods have not been considered for this site due to geological inhibitors and spatial site restriction. The implementation of rainwater harvesting to provide water for the terrace roof container gardens has been considered for the site. The terrace roof container gardens also increase the interception storage available for the site via increased evapotranspiration.

The foul drainage system has been designed with a pump system to provide for 23 residential units and 1 commercial unit. The calculate foul water flow rate is 6.29l/s and will be confirmed with Thames Water via a pre-development enquiry.

The overall benefit of this development would relieve pressure on the existing public sewer network and also increase both public and private amenity and biodiversity.

10 APPENDIX A: EXISTING TOPOGRAPHIC SURVEY