TRAIN & KEMP
CONSULTING ENGINEERS

Flood Risk Assessment

For Redevelopment of

38 Frognal Lane, NW3 6PP

Job No: 14604

5 October 2020

Revision 2

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Document Control

Revision	Date	Status
1	15 September 20	Draft
2	2 October 20	SDA Surface Water Drainage Strategy added

This report has been prepared by Train and Kemp (Consulting Engineers) LLP in accordance with the instructions of its client, Toxo Construction Ltd. No liability is extended to other parties.

1. INTRODUCTION

This site-specific Flood Risk Assessment has been prepared in support of a Planning Application for the redevelopment of 38 Frognal Lane NW3 6PP. Strictly, as a residential unit within Flood Zone 1, a Flood Risk Assessment is not required for planning of this site, but has been adopted as a convenient document for pulling together the relevant data for the Basement Impact Assessment.

This site specific flood risk assessment, FRA, has been prepared in accordance with:

i. National Planning Policy Framework, NPPF, 2019
ii. Planning Practice Guidance for Flood Risk and Coastal Change, FR&CC, as a live web base document originating in March 2014.
iii. Guidance on Flood Risk Assessments: Climate Change Allowances, CCA, February 2016.

Cognisance is taken of:

i. LB Camden Strategic Flood Risk Assessment, SFRA, which was issued May 2014, Ref 1. The SFRA is a planning tool in directing developments away from vulnerable flood risk areas.
ii. Camden Geological, Hydrogeological and Hydrological Study, CGHHS, 2009.
iii. LB Camden Flood Risk Management Strategy, FRMS, 2013.

1.1 Scope and Contents

The following support documents are appended to this FRA:

Appendix 1: EA Flood Maps for planning

2. LOCATION AND SITE DESCRIPTION

2.1 Location.

OS Grid Reference: 526004 185465
Flood Zone 1

The site is on the slopes falling from the high ground of Hampstead Heath towards the southwest. The site is a parallelogram with the road frontage along Frognal Lane being 27m by some 30m deep, front to rear.

The orientation is with Frognal Lane to the north.

2.2 Topography and Levels

The site is on the slope down from Hampstead village to the Finchley Road. The natural gradient is generally from northeast to southwest. The topographical survey shows that the gradient to this part of Frognal Lane is 1 in 10. This gradient is also repeated on Langland Gardens to the south west of the site.

The site is located on one of the steeper sections of Frognal Lane, opposite the junction to Chesterford Gardens with the ground rising to the east. The adjacent house to the east on Frognal Lane is No 40 which is some 3m higher. The adjacent house to the west is No 12 Langland Gardens; which is some 2m lower. See site location plan.

The site is level and it is clear that the ground has been terraced with retaining walls to the back of the pavement and to the front sections of the eastern and western boundaries. The natural fall of the ground means that the level difference is less pronounced towards the rear, where the differences are accommodated within banking and steeper slopes to the perimeter flower beds rather than formal retaining walls.

The forecourt off Frognal Lane is at +90.9m OD with the rear garden at +90.5m OD. The passageways to the east and west of the house are +91.3m OD and +90.6m OD respectively, with the maximum height of the eastern and western retaining walls at their northern front ends being 2m and 1m high respectively.

Adjacent Buildings
No 40 Frognal Lane is 19m to the east of No 38 and its lower ground floor is at +92m OD.

No 12 Langland Gardens is 2.5m to the west of No 38. The upper ground floor is at +88.8m OD and the lower ground floor, with access from Langland Gardens, is at +86.2m OD.

Next to No 12 Langland Gardens is Lindfield House, the back garden of which extends across the whole of the rear boundary to No 38. There are outhouses within 2m of this southern boundary, but with the slope of the ground these are estimated to be at +89m OD.

2.3 Existing Site and Building

38 Frognal Lane is a detached two storey house with pitched roof that has a single storey attached garage to the east. To the rear is a single storey extension that wraps around onto its western side. The house has a gravel forecourt and paved patio and path to the rear squaring off the edge of the rear lawn and garden.

The gravel forecourt does not have any formal drainage. The surface slopes down to the western pavement crossover and whilst the gravel provides storage, surface water will tend to discharge at the pavement crossover or percolate through the western retaining wall into the garden of No 12 Langland Gardens.

3. PROPOSED DEVELOPMENT

3.1. Proposed Redevelopment

The existing house is to be demolished and rebuilt as a two storey detached house with a basement. The basement will extend the width of the building in the east west direction but will be wider in the north south direction. It will be in two parts;

i. The front section, beneath the forecourt, will be 5m deep with a swimming pool.
ii. The rear section, beneath the main house will be 3m deep with a gym, home cinema and other leisure activities

There will be no habitable rooms in the basement; these will all be accommodated in the ground and 1st floors of the new house.

There will be lightwells to both the pool and the rear of the basement beyond the house.

3.2. Vulnerability Classification

As a residential development, the development is classified as “More Vulnerable”.

Given that the site is in Flood Zone 1, More Vulnerable use is appropriate.

4. FLOOD HAZARDS AND ASSESSMENTS

4.1 Historical Records and Zoning

SFRA Fig 3 iv shows that Frognal and Chesterford Gardens flooded in 2002 and possibly Langland Gardens in 1975, [the colouring of the road on the map being different to the key]. There is no record of any flooding on Frognal Lane. The area is classified as being within Critical Drainage Area 3_010.

Floods in Camden [2003] records that Frognal Gardens flooded in 2002

FRMS, Section 6.4 for West Hampstead states:

> 'The history of flooding in this area is significant with a number of areas in South and West Hampstead affected in both 1975 and 2002. However after the 2002 floods, Thames Water invested in significant new flood risk infrastructure as part of the West Hampstead Flood Relief Scheme. The project involved larger diameter sewers and a holding tank both of which have substantially reduced flood risk in the area.'

The Surface Water Management Plan, 2013, Fig 3.1 shows that LFRZ 3015, Frognal is located to the east of the site

4.2 Sources of Flooding

4.2.1 Fluvial

As EA Flood Map in Appendix 1, the site is in Flood Zone 1 with no risk of fluvial flooding

4.2.2 Surface Water

As EA Flood Map in Appendix 1, surface water run off from the north has caused localised surface water flooding to the southern end of Chesterford Gardens. Frognal Lane has a gradient of 1 in 10 at its junction with Chesterford Gardens and once the surface water has flowed around the corner, Frognal Lane will act as an open channel discharging the water down the hill. There will be no ponding of surface water on Frognal Lane.

4.2.3 Reservoirs and Man made Water Features

As EA Flood Map in Appendix 1, there are no reservoirs in the vicinity and Hampstead Ponds are too remote.

4.2.4 Hydrogeology & Groundwater

The site is founded on the Claygate Member overlying London Clay which outcrops further to the south on Lindfield Gardens. As shown on CGHH Fig 8, Aquifer Designation Map, the Claygate Member is a Secondary A Aquifer.

Water will tend to collect at the base of Claygate Member perching above the impervious London Clay, causing surface seepages where the underlying London Clay reaches ground surface. Given the anticipated moderately low permeability of this silty sandy clay, the Claygate Member is expected to contain water all year round.

4.2.5 Sewers

There are no records of sewer flooding in West Hampstead, separate from the surface water events in 4.2.2.

4.2.6 Water Management

As reported in LB Camden Flood Risk Management, Thames Water have undertaken flood alleviation schemes in West Hampstead since the 2002 floods

4.3 Pathways and Mechanisms

The two pathways are surface water flows from Chesterford Gardens and groundwater flows to the base of the Claygate Member.

With the gradient on Frognal Lane, the discharge from Chesterford Gardens will flow down the hill to the west; there will not be any ponding.

Any groundwater flows will be at the spring line at +82m OD, immediately above the London Clay outcrop and some 100m from the site.

4.4 Drainage Arrangements

Currently, both the foul and surface water discharge to adopted sewers.

5. CLIMATE CHANGE

Global sea levels will continue to rise and peak rainfall intensity and river flows will increase over the next century.

As discussed in Climate Change Assessment, Table 1, allowances for a More Vulnerable site in Flood Zone 1 in the Thames Basin will have increases in rainfall of 40%.

6. FLOOD MITIGATION

As reported in FRMS, flood mitigation measures have been installed in West Hampstead since the 2002 flooding and no problems were reported with the 2012 floods in the Borough.

7. SUDS

A drainage strategy has been prepared by Simon Dent Associates. SUDS techniques will be adopted to mitigate the impact of the development on flooding in the area.

Rainwater downpipes shall be provided with water butts to assist in reusing rainwater for irrigation and gardening.

Infiltration rates of the Claygate members are too low to allow the use of soakaways. All storm water discharges from the site will be intercepted by attenuation geocells with the final flow control chamber restricting run off from the site to 2.0 lit/sec; this flow control being the lowest practicable non mechanical flow control device available and replicating as near to existing greenfield run off rates as possible.

8. OFF SITE IMPACTS

The drainage regime will be maintained as present. There are no significant changes to the footprint and impervious area of the above ground building. There will be an increase in the impervious area with the swimming pool beneath the forecourt, but this will be less than $20m^2$ and will be compensated with the surface water storage provision.

The site is too small to have any impact on the flood risk of the surrounding area.

9. FLOOD LEVEL FOR ASSESSMENT

There is no fluvial flooding event. There could be significant surface water flows on Frognal Lane if Chesterford Gardens floods, but with the gradient, this will be shallow fast flowing and there will be no ponding or flooding.

With flow down Frognal Lane, there could be eddies and backflow at No 38's pavement crossover at +90.8m OD; this could lead to minor flows onto the site. Consequently a flood level of +90.85m OD has been adopted.

10. RESIDUAL RISKS

10.1 Freeboard Allowance

Whilst the recommended freeboard for fluvial flooding is 0.3m, this is over onerous for a localised surface water event on an adjacent road. Given the arrangement of the forecourt with the entrance in the middle of the front elevation, a freeboard of 0.15m is considered adequate giving a free board level of +91.0m.

The freeboard level of +91.0m should be provided:

- As a mound to the forecourt to the east of the pavement crossover
- As a threshold to the western pathway to the side of the house
- At the kerb to the basement lightwells.

10.2 Habitable Rooms and Bedrooms

There are no habitable rooms or bedrooms in the basement.

10.3 Safe Egress and Flood Plans

Given the uncertainties of future flood risks, safe egress is fundamental.

Thames Water mitigation measures have improved the local surface water drainage, and there have been no problems since 2002. The construction of pedestrian access steps and gate to the east of Chesterford Gardens would allow safe egress in severe surface water events.

10.4 Flood Resistant and Flood Resilient Construction

The swimming pool will be flood resilient construction and sensibly the remainder of the basement construction should be similar.

11. CONCLUSION

The reconstruction of the house with a basement will not impact on the flood risk of the area.

SUDS will reduce the impact of the surface water discharge into the adopted sewer.

The forecourt level should include a mound to a level of +91.0 OD to take cognisance of any backflow onto the site from surface water flowing down Frognal Lane.

Appendix 1: EA Flood Maps

Flood map for planning

Your reference	Location (easting/northing)	Created
38 Frognal Ln	**526004/185465**	**2 Sep 2020 14:30**

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Environment Agency

Flood map for planning

Your reference
38 Frognal Ln

Location (easting/northing)
526004/185465

Scale
1:2500

Created
2 Sep 2020 14:30

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

Surface Water Flooding

Extent of Reservoir Flooding

Appendix 2: Surface Water Drainage Strategy on SDA Drawing 1611-100

ALWAYS PRINT THIS DRAWING IN COLOUR

GROUND DRAINAGE SPECIFICATION NOTES

- ALL BELOW SLAB PIPES SHALL BE IN CAST IRON AND ENCASED IN CONCRETE AS DETAIL No.2 WHERE BENEATH THE SLAB AS SAINT GOBAIN 'ENSIGN' RANGE OF PIPES AND FITTINGS TO BS EN 877. ALL BRANCHES TO MAIN RUNS SHALL BE MADE USING 45° BRANCHES AND BENDS TO SUIT. NO SHARP 90° BENDS WILL BE ACCEPTED. ONLY LONG RADIUS BENDS ARE TO BE USED AT BASE OF DRAINAGE BENDS.
- EXTERNAL DRAINAGE MAY BE RUN IN CLASS S GRANULAR BED AND SURROUND WHERE GREATER THAN 900mm DEPTH OF COVER, WHERE LESS COVER ALWAYS PROVIDE ADDITIONAL PROTECTION AS RECOMMENDED BY SDA DETAILS OR WHERE MORE STRINGENT PIPE MANUFACTURERS RECOMMENDATIONS PREVAIL.
- ALL DRAINAGE INSTALLATION SHALL CONFORM TO BS EN 752, BS EN 12056, APPROVED BUILDING REGULATION DOCUMENT H AND BS 8000 FOR WORKMANSHIP AND ANY PARTICULAR REQUIREMENTS OF THE BUILDING CONTROL OFFICER AND VARIOUS MANUFACTURERS OF THE SPECIFIED PRODUCTS. THE WHOLE DRAINAGE SYSTEM SHALL BE TESTED AND COMMISSIONED TO BS 752, 12056 AND 8000.
- PIPE CONNECTIONS AND BRANCHES MUST USE A MAX ANGLE OF 45 DEGREE BEND AND BRANCH SWEEP INTO THE MAIN DRAINAGE RUNS - SEE DETAILS. CONNECTIONS OF 90 DEG WILL NOT BE PERMITTED BY SDA ONTO THE MAIN RUN.
- ALL SVPs AND SSs SHALL HAVE ACCESS 1.0m AFFL TO ENSURE ALL LENGTHS CAN BE RODDED AND MAINTAINED. PROVIDE 300 x 200 MIN SIZE ACCESS DOORS ON STUD WALLS WHERE PIPE ACCESS IS COVERED.
- WHERE PIPE VENTILATION IS SHOWN BY AAV, SDA ONLY RECOMMEND THE MARLEY 'DURGO' VALVE FOR USE AS AN AAV.
- THE CONTRACTOR SHALL CARRY OUT AIR TESTING IN ACCORDANCE WITH BS 8000 FOR ALL DRAINAGE RUNS AND SHALL PRODUCE A CERTIFICATE FOR ISSUE TO THE BUILDING CONTROL OFFICER. THE CONTRACTOR SHALL REQUEST THE BCO WITNESS THE FINAL DRAINAGE PIPEWORK TESTING.
- THE CONTRACTOR SHALL ENSURE A FULL CCTV OF ALL THE INSTALLED DRAINAGE IS RECORDED WITH DVD VIDEO AND REPORT SENT TO THE CLIENT FOLLOWING PRACTICAL COMPLETION AND WITHIN 3 WEEKS OF HANDOVER.

ABBREVIATIONS

AAV	AIR ADMITTANCE VALVE
AC	ACCESS CHAMBER
ACC	ACCESS
ASBC	ASBESTOS CEMENT
AFFL	ABOVE FINISHED FLOOR LEVEL
BD	BACKDROP
BIG	BACK INLET GULLY
BR	BRANCH
BSSL	BELOW SLAB SOFFIT LEVEL
CD	COMBINED DRAIN
CE	CLEANING EYE
CI	CAST IRON
CL	COVER LEVEL
CP	CATCHPIT
DC	DRAINAGE CHANNEL
DCO	DRAINAGE CHANNEL OUTLET
DTC	DRAINAGE THRESHOLD CHANNEL
DP	DRAIN POINT
FA	FROM ABOVE
FB	FROM BELOW
FC	FRESH AIR INLET
FAI	FLEXIBLE CONNECTION
FWD	FOUL WATER DRAIN
FWS	FOUL WATER SEWER
GL	GROUND LEVEL
HL	HIGH LEVEL
IC	INSPECTION CHAMBER
IL	INVERT LEVEL
IT	INTERCEPTING TRAP
LL	LOW LEVEL
LWG	LIGHTWELL GULLY
MH	MANHOLE
ML	MID LEVEL
OTG	OPEN TOP GULLY
PM	PUMP MAIN
PP	POLYPROPYLENE
PPAC	POLYPROPYLENE AC
PPIC	POLYPROPYLENE IC
PCC	PRECAST CONCRETE
PVC	POLYVINYL CHLORIDE
RE	RODDING EYE
RG	ROAD GULLY
RWP	RAINWATER PIPE
SP	SOIL PIPE
SHG	SHOWER GULLY
STBIG	SEALED TOP BACK INLET GULLY
STP	SEWAGE TREATMENT PLANT
SVP	SOIL VENT PIPE
SS	STUB STACK
SWD	STORM WATER DRAIN
SWS	STORM WATER SEWER
TA	TO ABOVE
TB	TO BELOW
TBC	TO BE CONFIRMED
TD	TO DRAIN
UB	URINAL BOWL
UTL	UNABLE TO LIFT
UTT	UNABLE TO TRACE
UTS	UNABLE TO SURVEY
VC	VITRIFIED CLAYWARE
VTA	VENT TO ATMOSPHERE
WC	WATER CLOSET
WHB	WASH HAND BASIN
WG	WASTE GULLY
WP	WASTE PIPE
WVP	WASTE VENT PIPE
YG	YARD GULLY

EXISTING FOUL WATER LEGEND / KEY

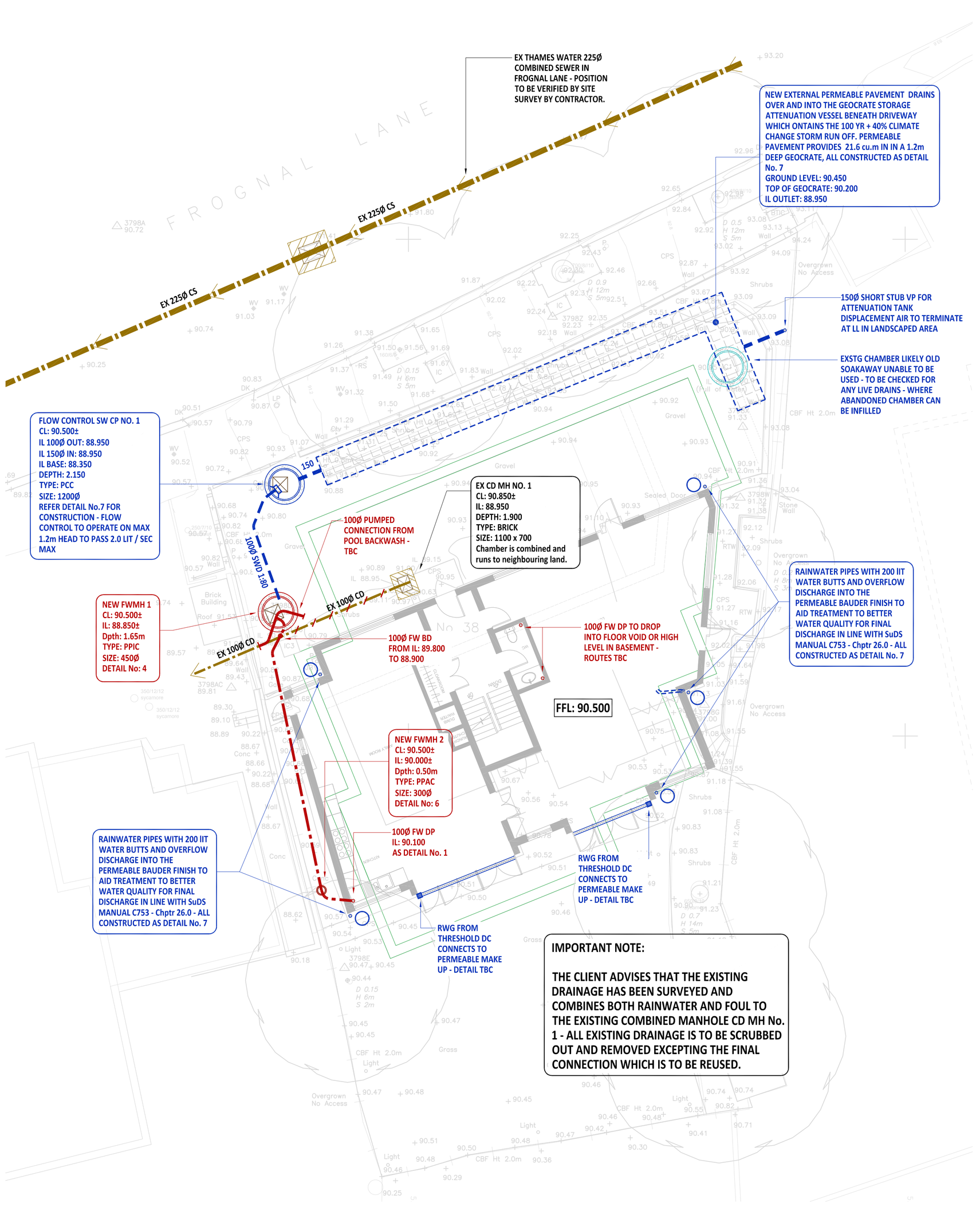
- EXISTING FWD WITH GRADIENT AND CCTV SECTION REF — 100Ø FWD - 1:40 - [S4]
- EXISTING BRICK CHAMBER - REFER EX 001 FOR SIZE
- EXISTING PRECAST CONCRETE (PCC) RING CHAMBER - REFER EX 001 FOR SIZE
- EXISTING 450Ø PPIC - ALL 150Ø INLETS / OUTLETS
- EXISTING 450Ø PPIC - ALL 100Ø INLETS / OUTLETS
- EXISTING 225 / 300 Ø PPAC
- EXISTING FWG GULLY
- EXISTING FW DP - SVP - SS
- EXISTING INTERCEPTOR TRAP (IT)

PROPOSED FW DRAINAGE LEGEND / KEY

- PROPOSED FWD / GRADIENT / BEDDING — 100Ø FWD - 1:40 - CLASS S
- EXSTG SP or SVP AT HL
- NEW SP or SVP AT HL
- EXSTG FWD REMOVED
- PROPOSED PC RECTANGULAR CHAMBER AS DETAIL No. - REFER 100 FOR SIZE
- PROPOSED PC RING CHAMBER AS DETAIL No. - REFER 100 FOR SIZE
- PROPOSED 450Ø PPIC - ALL 150Ø INLETS / OUTLETS AS DETAIL No. 4
- PROPOSED 450Ø PPIC - ALL 100Ø INLETS / OUTLETS - AS DETAIL No. 4
- PROPOSED 225 / 300 Ø PPAC AS DETAIL No. 6
- PROPOSED FWG GULLY - REFER 100 FOR TYPE - AS DETAIL No.
- PROPOSED FW DP - SVP - SS AS DETAIL No. 1

PROPOSED FW DRAINAGE LEGEND / KEY

- PROPOSED SWD / GRADIENT / BEDDING — 100Ø FWD - 1:40 - CLASS S
- EXSTG SWD REMOVED
- PROPOSED PC RECTANGULAR CHAMBER AS DETAIL No. - REFER 100 FOR SIZE
- PROPOSED PC RING CHAMBER AS DETAIL No. - REFER 100 FOR SIZE
- PROPOSED 675Ø PP CP AS DETAIL No.
- PROPOSED 225 / 300 Ø PPAC AS DETAIL No. 6
- PROPOSED FWG GULLY - REFER 100 FOR TYPE - AS DETAIL No.
- PROPOSED FW DP - SVP - SS AS DETAIL No. 1



FOUL & STORM WATER DESIGN - DRAINAGE STRATEGY

GENERAL - The drainage scheme shown is designed to aid planning approval for the development.

The existing drainage system has been surveyed and found to be combined converging to the existing manhole CD MH No. 1. All existing drainage from the existing house will be removed and replaced with the new drainage shown, save the final existing connection which will be reused.

STORM WATER - The existing site measures some 690 sq.m in area. it is located in flood zone 1 area for fluvial flooding. The proposed site offer the following areas:-

Impermeable Roof/patios/alleyways - 230 sq.m
Permeable driveway - 150 sq.m
Permeable soft areas - 310 sq.m

The greenfield run off rates have been established as follows:-

1 year	0.38 lit/sec
30 year	1.02 lit/sec
100 year	1.41 lit/sec

Please note that these figures are for sites with a minimum area of 0.1 ha, ie 1000 sq.m, which is greater than our site area.

Impermeable Roof
All new drainage from the roof areas will be piped to downpipes which will drain via water butts to drop into the permeable paving aroud the house and in the driveway. From here flows will track across and drop into the geocell storage at the front driveway.

Permeable Driveway and external pathways
This will have a permeable surface layer of using a manufactured polymer cavity drainage board with stone infill and open jointed slabs above, to the architects details. Flows will then drop into the polypropylene geocrate system and provide the 100 year + 40% climate change event storage event for the peak storm with a 150mm dia outfall to the final flow control chamber SW CP No. 1. From here a 'Hydrobrake' is used to limit flows from the development to a maximum of 2.0 lit/sec at max of 1.2m head which is the least practicable flow that can be achieved with a non mechanical flow control device.

DESIGN EXCEEDANCE FLOWS - Where design storms and attenuation volumes are exceeded, such flows will run down the road towards the rear of the site.

DISCHARGE WATER QUALITY - The SuDS Manual C753 Chapter 26 requires that discharge waters be treated. All roof and surface water pass through a filter medium which uses a polypropylene cavity drainage board infilled with a stone medium. Additionally all surface water is settled through a final catchpit which allow any final solid particles to be deposited and be removed.

MAINTENANCE LIABILITIES - Where attenuated volumes are provided in permeable construction make ups which are inaccessible without conventional excavation, it is important to provide features on the drainage system which minimise silt migration. All water butts will collect silt and these should be regularly cleaned to suit.

The catchpit chambers should also be cleaned out and emptied regularly twice a year to ensure their functionability.

All pipes should be cleaned/jetted once a year equipment.

FOUL WATER - There is an existing 225mm dia combined sewer in Frognal Lane with an existing combined connection from the site which will be reused for foul and storm water.

The client advises that this existing pipe connection has been CCTV surveyed with no detectable major damage to the pipe hence its reuse.

Rev	Description	Date	By
P2	Updated to suit latest house ground floor, basement and sub structure	07.10.2020	SAD
P1	PRELIMINARY ISSUE	30.03.2020	SAD

CLIENT:
MRRP

PROJECT:
38 Frognal Lane Hampstead London NW3 6PP

TITLE:
Proposed Ground floor & Site Drainage

DRAWING STATUS:
PLANNING

PROJECT REF:	SCALE:	DWG No:	REV:
1611	@ A1 - 1:100 @ A3 - 1:200	1611-100	P2

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