39 Oak Avenue

SuDS Assessment

Job Number: 1163

Date	Version	Notes/Amendments
January 2022	1	Issued for Information
July 2022	2	Updated drawings

Contents **Page**

Acronyms	
AOD	Above Ordnance Datum
CIRIA	Construction Industry Research and Information Association
EA	Environment Agency
SFRA	Strategic Flood Risk Assessment
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
SuDS	Sustainable Drainage Systems
NSTS	Sustainable drainage systems: non-statutory technical standards

Introduction

Flume Consultants have been appointed to undertake a SuDS Assessment for the proposed development at 39 Oak Avenue, Ickenham, Uxbridge, UB10 8LR.

This report has been carried out in accordance with advice and guidance from the Environment Agency (EA), the Strategic Flood Risk Assessment (SFRA) produced by London Borough of Hillingdon, their Local Plan and related CIRIA documents.

The Environment Agency's (EA) indicative floodplain map shows that the site is located in Flood Zone 1, however a SuDS Assessment has been carried out to assess the available options for SuDS use for the proposed development.

The local authority have placed a pre-commencement condition on the proposed works and have requested the developer provide the following information. This report aims to satisfy these requirements and release the outstanding condition:

i. Information about the design storm period and intensity, the method employed to delay and control the surface water discharged from the site and the measures taken to prevent pollution of the receiving groundwater and/or surface waters; ✓ → Page 6-8, Figure 4.
ii. A timetable for its implementation; and ✓ → The project should be fully constructed by the end of 2022. This includes the full implementation and maintenance of the proposed SuDS Systems outlined within this report.
iii. Provide a management and maintenance plan for the lifetime of the development which shall include the arrangements for adoption by any public authority or statutory undertaker and any other arrangements to secure the operation of the scheme throughout its lifetime. ✓ → Surface Water Maintenance Strategy (Page 15)

The scheme should also demonstrate the use of methods to minimise the use of potable water through water collection, reuse and recycling and:
iv. Provide details of water collection facilities to capture excess rainwater; ✓ → Page 8-14
v. Provide details of how rain and grey water will be recycled and reused in the development. ✓ → Page 8-14. Rainwater will be reused in the form of Watering Butts for landscaping and car washing etc.
vi. Details of how the dwelling will achieve a water efficiency standard of no more than 110 litres per person per day maximum water consumption (to include a fixed factor of water for outdoor use of 5 litres per person per day in accordance with the optional requirement defined within Approved Document G of the Building Regulations). ✓ → Estimated water usage needs to be calculated, unless the water fittings used follow the guidance in Tables 2.1 and 2.2 of Approved Document G of the Building Regulations. The optional requirement level (Table 2.2) for this development will be adhered to, including the use of Watering Butts for Rainwater re-use to satisfy this condition.

Site Description and Location

The current property is a detached bungalow along a street with a mix of detached bungalows, and two-storey dwelling properties and its rear gardens facing Parkfield Road rear gardens. The front elevation of No. 39 is visible from Oak Avenue, separated by a public footpath. Immediately to the rear of the property is a mix of hard and soft landscaping, with the main access door at the front of the building facing Oak Avenue. The building itself is approximately 0.75 kilometres north of the nearest main watercourse; the River Pinn.

The site postcode is UB10 8LR and the OS grid reference is TQ 07873 86742.

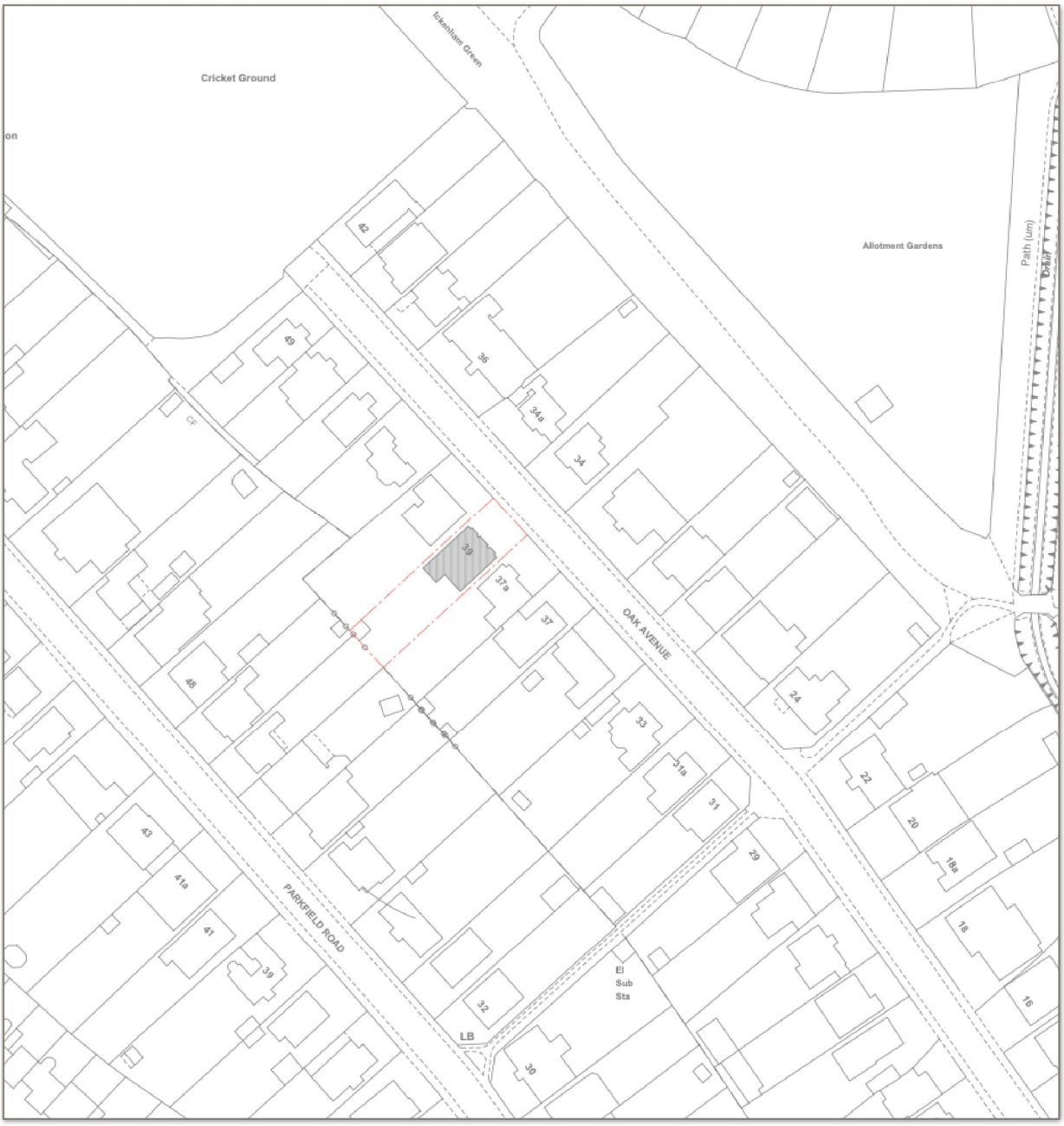


FIGURE 1. SITE LOCATION

Flood Risk

The EA's indicative floodplain map shows that the site is located in Flood Zone 1 and is not at risk of flooding (Figure 2). Developments in this flood zone do not have any restrictions, provided they do not increase the risk of flooding elsewhere.

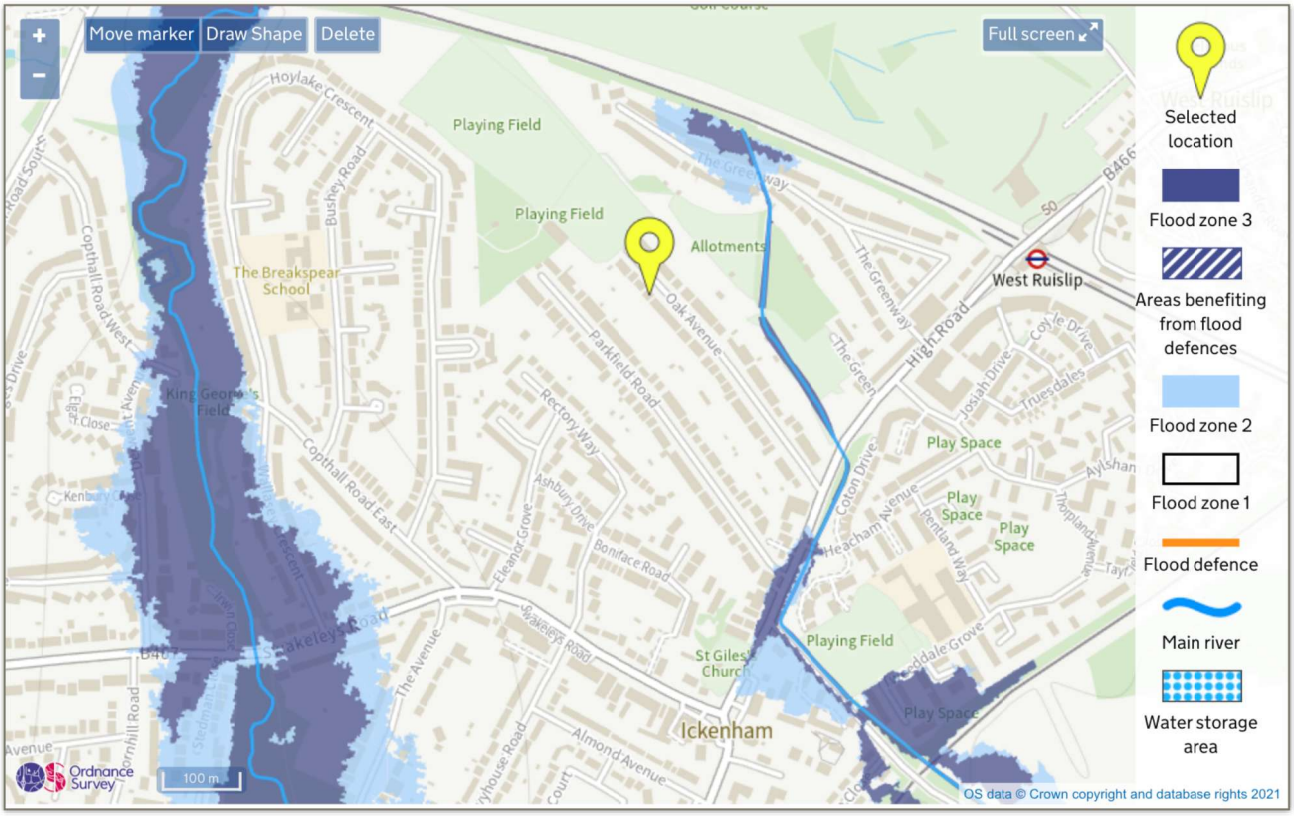


FIGURE 2. ENVIRONMENT AGENCY FLOOD RISK FROM RIVERS OR SEA MAP (GOV.UK, 2022)

Development Proposal

The proposal involves the demolition and replacement of the existing detached bungalow with a new two-story detached dwelling, including use of loft space as a habitable and rear dormer, together with alterations to the front driveway.

Figure 3 indicates the proposed development. Refer to Appendix A for the proposed SuDS Sketch.

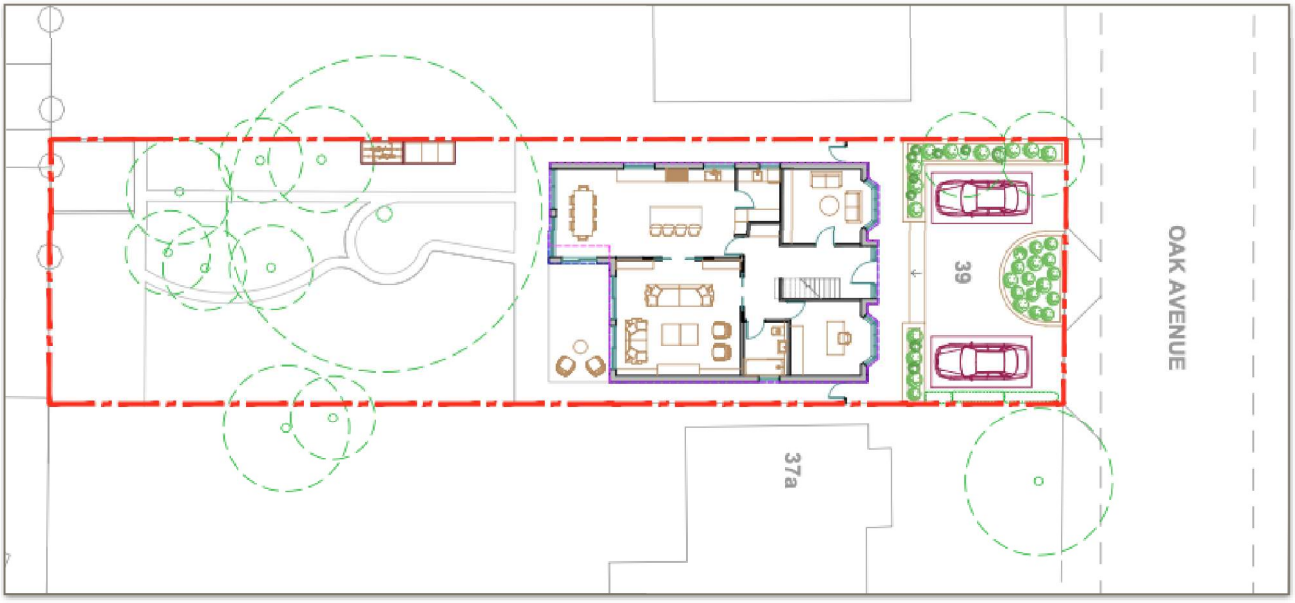


FIGURE 3. PROPOSED SITE PLAN.

Surface Water Run-off Assessment

Existing Run-off

The total site area which includes the existing building and associated external landscaping, is approximately 610m²/0.061ha, and 300m² of which is impermeable hardstanding areas.

The existing peak run-off rate for the design storm event (1 in 1, 1 in 30 and 1 in 100 year) was calculated using the modified rational method as shown below:

Q_{1ex} = 2.78 x 33 x 0.03 = 2.75 l/s
Q_{30ex} = 2.78 x 83 x 0.03 = 6.92 l/s
Q_{100ex} = 2.78 x 106 x 0.03 = 8.84 l/s

Proposed Run-off (without SuDS Measures)

According to Planning Practice Guidance (PPG), *"generally the aim should be discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable: 1. Into the ground (infiltration) 2. To a surface water body; 3. To a surface water sewer, highway drain or another drainage system; 4. To a combined sewer",* whilst ensuring that surface water run-off is managed as close to its source as possible.

The proposed development will not increase the impermeable areas and therefore will not increase the surface water run-off or surface water volumes from the development. However, SuDS will be incorporated in the scheme where possible.

Please refer to Figure 4, outlining the possibility of incorporating SuDS into the scheme.

SuDS Assessment

It is recommended that Sustainable Drainage Systems (SuDS) be introduced to mimic natural drainage pathways as close to source as possible, reducing the impact of urbanisation on watercourse flows, and ensures the protection and enhancement of water quality, while encouraging the recharge of groundwater.

In accordance with the EA's guidelines, DEFRA's Non-statutory technical standards for sustainable drainage systems (NSTS), Building Regulations and Water Authorities advice, surface water run-off should be managed as close to its source as possible. The proposed SuDS will aim to reduce surface water run-off to the required rates where possible and practical, in line with Policy 5.13 of the London Plan.

The NSTS states stormwater flows off site should achieve the greenfield runoff rate as best practicably possible, or are at least a 50% betterment of the existing flow rates for all periods.

CIRIA SuDS Manual (C753) states that a development should utilise SuDS unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

I. Use infiltration techniques, such as porous surfaces in non-clay areas,
II. attenuate rainwater in ponds or open water features for gradual release,
III. attenuate rainwater by storing in tanks or sealed water features for gradual release,
IV. discharge rainwater direct to a watercourse,
V. discharge rainwater to a surface water sewer / drain,
VI. discharge rainwater to the combined sewer.

The possibility of implementing SUDS at the site was assessed using a hierarchy of preferred surface water management methods. The following paragraphs discuss the various methods in order of that hierarchy and evaluate the site's suitability for each method. Please refer to the SuDS site suitability, in Figure 4, used to determine the suitability for each SuDS element for this development.

SuDS Component	Site Suitability	Comments
Green Roofs & Rainwater Reuse	✓	A Raingarden Planter will be introduced to accommodate additional run-off from the existing building. Watering Butts may also be introduced in the form of an above ground surface water holding chamber which will be used for landscaping purposes (rainwater reuse).
Soakaways	✗	Not suitable due to the space constraints on site to adhere to the necessary easements (minimum 5m easement from adjacent structures and 2.5m easement from boundaries which restricts their use).
Filter Strips	✗	Not suitable due to the space constraints on site to adhere to the necessary easements (minimum 5m easement from adjacent structures and 2.5m easement from boundaries which restricts their use).
Infiltration Trenches	✗	Not suitable due to the space constraints on site to adhere to the necessary easements (minimum 5m easement from adjacent structures and 2.5m easement from boundaries which restricts their use).
Swales	✗	Not suitable due to site layout and size of the development.
Bioretention	✗	Not suitable due to site layout and size of the development.
Porous Pavements	✓	Permeable Paving will be introduced to the front of the building serving the parking area - infiltrating into the ground with an overflow to the private drainage system.
Geocellular Systems	✗	Not appropriate given the size of the building whilst considering the increase in blockage risk associated with low flow devices.
Infiltration basins	✗	Not suitable due to site layout and size of the development.
Detention basins	✗	Not suitable due to site layout and size of the development.
Ponds	✗	Not suitable due to site layout and size of the development.
Stormwater wetlands	✗	Not suitable due to site layout and size of the development.

FIGURE 4. SUDS SITE SUITABILITY

Living Roofs & Rainwater Re-use

Rain Garden Planters will be used to partially drain surface water run-off from the roof. An overflow will be provided, which will drain back into the rainwater pipes serving the terrace.

Figure 5 provides a schematic of the Rain Garden Planter.

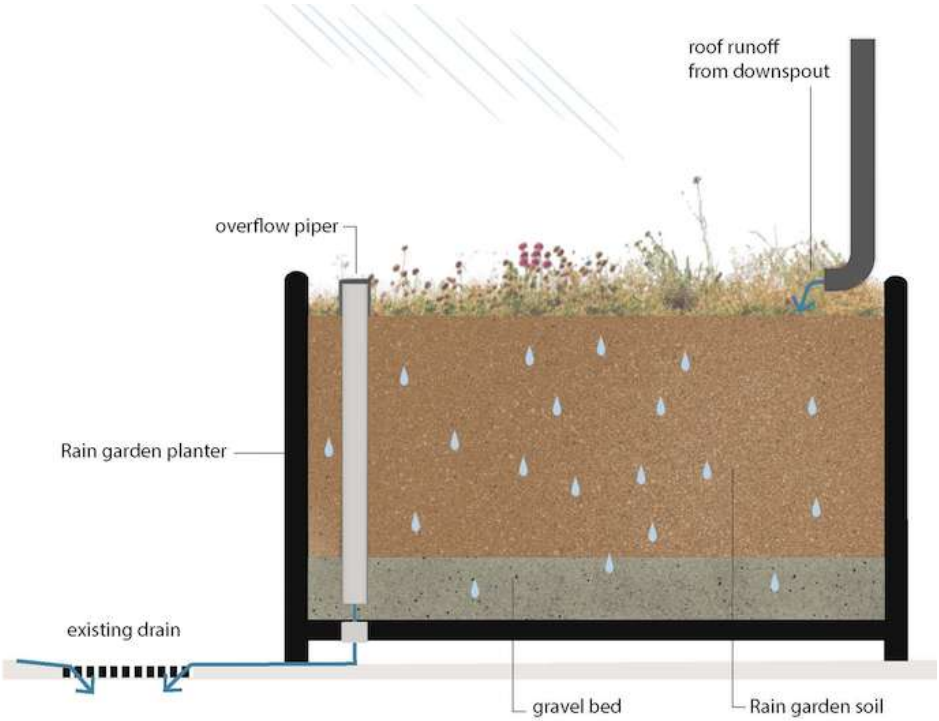


FIGURE 5. RAIN GARDEN RAISED PLANTER DETAIL USED FOR SURFACE WATER RUN-OFF FROM ROOF

Infiltration

The preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration system. Ground Investigation was not available at the time of writing this report, however based on the geological maps (Figure 6), the EA/DEFRA's maps confirm that infiltration could be limited in this instance due to the presence of the London Clay Formation - Clay, Silt And Sand. However, Infiltration could be used to partially drain the hardstanding areas. Infiltration through permeable paving is considered to be a practical solution to reduce surface water run-off rates and volumes. It is proposed to utilise permeable paving for the external hardstanding areas, infiltrating to ground and reducing the run-off by approximately **100m²**. Centralised '3d' soakaways are not feasible due to the proximity to adjacent structures. The requirement for a minimum 5m easement from adjacent structures restricts their use.

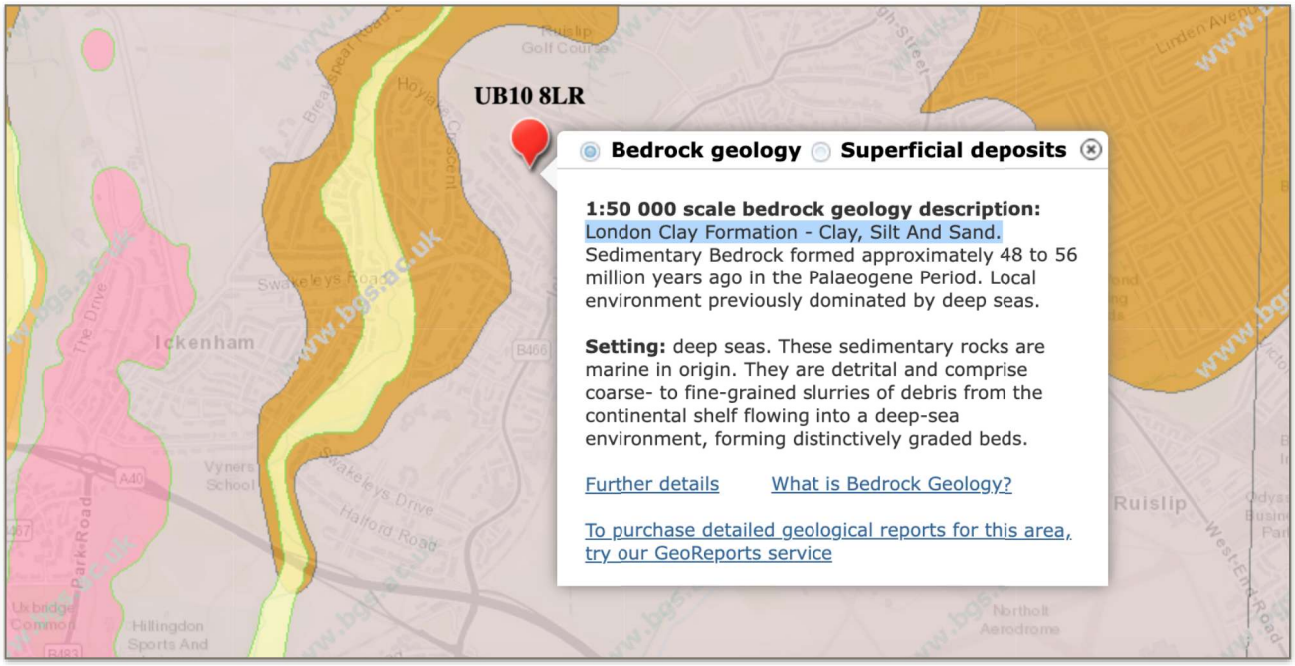


FIGURE 6. BRITISH GEOLOGICAL SURVEY MAPS (BGS, 2022)

Raingarden Planters will also be incorporated to reduce the surface water run-off for the small-medium storm events. Based on a conservative figure of 20% discharging into these planters, this will reduce the surface water run-off by an additional **20m²** during these events.

Attenuation capacity of Raingarden Planters

Design Standard	Depth of Rainfall
First Flush	5mm
1 in 5 year event	20mm
1 in 20 year event	50mm

Rainfall design events, based on a 60 minute duration storm in the London area

For Rain Gardens, good practice is to aim to store the first 20mm of rainfall – in London this is the estimated depth of rainfall for an hour storm with an annual probability of 1 in 5.

Area of Rain Garden Planter= $2m^2$
Catchment Area = $20m^2$ *(Approximate area run-off served by RWP)*
Depth of Freeboard = 0.10m
Depth of Sub-base = 0.30m

Depth of Storage = Depth of Freeboard (m) + 30% Depth of Sub-base (m)
= 0.10m + 30% of 0.30m
= 0.19m

Volume of Storage = Depth of Storage x Area of Rain Garden
= 0.19m x $2m^2$ = $0.38m^3$

Volume of Rainfall = Depth of Rainfall x Catchment Area
1 in 5 year storm event = 20mm x $20m^2$ = $0.40m^3$

In this instance a 20mm 1 in 5 year event is exceeded but only just. All other less frequent storm events would be retained within the Rain Garden Planter.

Permeable Paving

Infiltration through permeable paving (Type B) is considered to be a practical solution to reduce surface water run-off rates and volumes. Infiltration through Permeable Pavements (2D plane only) can also be utilised closer to structures, with a 2m easement (Figure 7), whereas centralised soakaways as part of a 3D (multiple plane) infiltration system should be placed a minimum of 5m from structures. Permeable Pavements serving themselves behave in a similar way to soft landscaping and can be placed directly against the edge of structures.

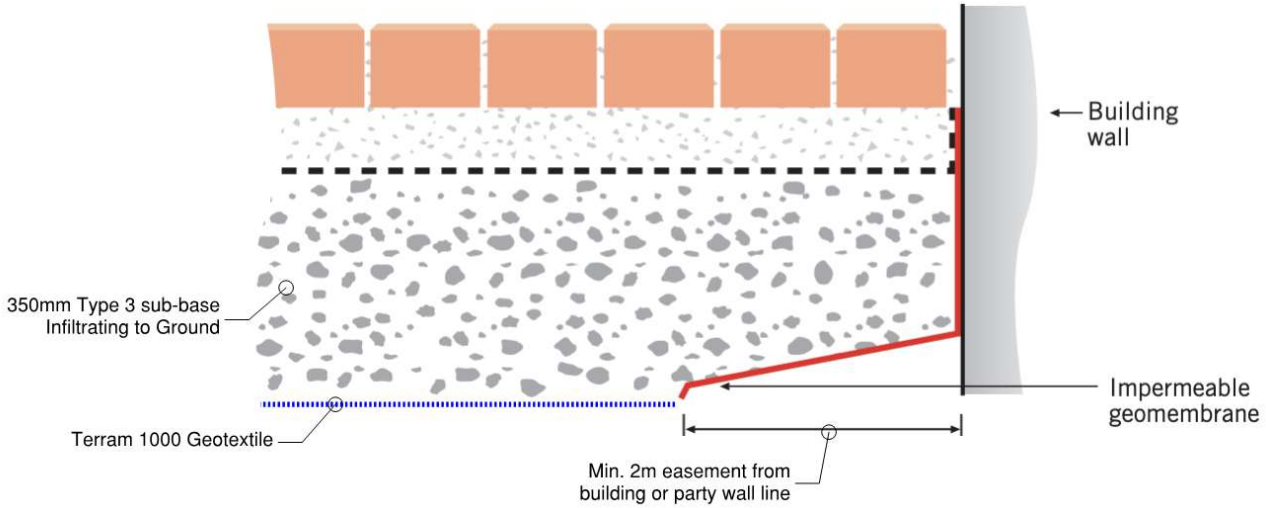


FIGURE 7. PERMEABLE PAVEMENT USED FOR THE HARDSTANDING AREA

Attenuation capacity of the Permeable Pavement

The surface water run-off from the permeable paving will self-attenuate and infiltrate into the ground. It is not possible, to transfer additional surface water drainage from the existing building as discussed in Figure 4. However, we have made an allowance for any future development in the calculations to allow for additional surface water run-off volumes (+40% conservative allowance for *Urban Creep*).

To allow for the extra rainfall being collected, the permeable construction thickness will be increased to give a larger storage volume. According to Interpave guidance[1], the following calculation can be used to determine this volume:

T=t(AI +AP)/AP

Where:
T = Thickness of permeable construction to store water from impermeable and permeable contributing areas
t = Thickness of permeable construction to store water from permeable area only (50mm)
AI = Area of impermeable surfacing draining onto the permeable area
AP = Area of CBPP.

T = 50(40 + 100)/100 = 70mm

Therefore, the permeable pavement (350mm thick) has adequate capacity to accommodate the additional surface water run-off.

These calculations are based on a 30% void ratio of the permeable sub-base. The following compares the required volumes of the permeable pavements, and the achieved volumes within the permeable sub-base:

Required volume:
= 100x0.07(0.30)
= 2.10m^3

Achieved volume:
= 100x0.350(0.30)
= 10.50m^3

[1] Interpave's Design and Construction of Concrete Block Permeable Pavements

SuDS Run-off Summary

Return Period	Greenfield	Existing	Proposed (without SuDS Measures)	Proposed (with SuDS Measures)
1 in 1 Year	0.30	2.75	2.75	1.65 (permeable paving and the surface water run-off from the roof discharging into the Raingarden Planter)
1 in 30 Year	0.80	6.92	6.92	4.61 (only accounting for permeable paving)
1 in 100 Year	1.12	8.84	8.84	5.89 (only accounting for permeable paving)
1 in 100 Year + 40%cc	-	-	12.38	8.25 (only accounting for permeable paving)

In conclusion, the incorporation of Permeable Paving (Type B) will reduce the proposed surface water run-off from the development. Furthermore, the incorporation of Rain Garden Planters and Watering Butts, will also reduce the development's surface water run-off rates for the small-medium storm events. These SuDS elements provide an overall reduction in run-off rates for all storm events up to the 1 in 100 year compared to the existing development by up to **40%**.

Surface Water Maintenance Strategy

The drainage design will be designed to be fully maintainable in accordance with building regulations and the recommendations of CIRIA C753 – SUDs Manual, outlined below.

Rain Garden Planters

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Weed spray with environmentally friendly chemicals	Half yearly
	Clear leaves and litter	Half yearly
	Plants to be pruned	Half yearly
Occasional maintenance	Remove silt build-up from inlets and surface and replace mulch as necessary	Annually, or as required
	Remove silt build-up from outlets and surface and replace mulch as necessary	Annually, or as required
Remedial Actions	Repair of overflow erosion damage or damage to outfall	As required

Permeable Paving

Maintenance Schedule	Required Action	Typical Frequency
Monitoring/Insections	Initial Inspection.	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth - if required take remedial action.	Annually (and after severe storms)
Regular Maintenance	Rubbish and litter removal	As required
	Brushing and vacuuming - standard cosmetic sweep across surface	Once a year after Autumn leaf fall
Remedial Actions	Remedial work to any depressions or rutting considered detrimental to the structural performance.	As required
	Rehabilitation of surface with remedial sweeping	Every 10-15 years or as required.

Conclusions

- The site resides in Flood Zone 1 where there is less than 1 in 1000 annual probability of river or sea flooding (<0.1%). Developments in this flood zone have no restrictions other than ensuring surface water drainage proposals do not increase the flood risk on site and the surrounding areas.

- The proposed replacement dwelling will not increase the impermeable areas on the site, as the proposed extension replaces existing hard paved areas which discharge at unrestricted rates to the public sewer. It will therefore not increase the flood risk from surface water, as there will be no increase in the surface water run-off rate or volumes.

- There will be no increase in the impermeable area of the site and the resulting discharge rates and volumes of surface water run-off from the development. However, Infiltration will be prioritised on site where possible, with the use of permeable paving serving the external hardstanding areas infiltrating to ground. Furthermore, above ground rainwater garden planters will be used, along with watering butts at ground floor. These SuDS features will reduce the surface water run-off by up to 40% compared to existing, which is far as is practical in line with the London Plan.

- A SuDS Maintenance Plan will also be in place to ensure efficient operation and prevent failure of the system.

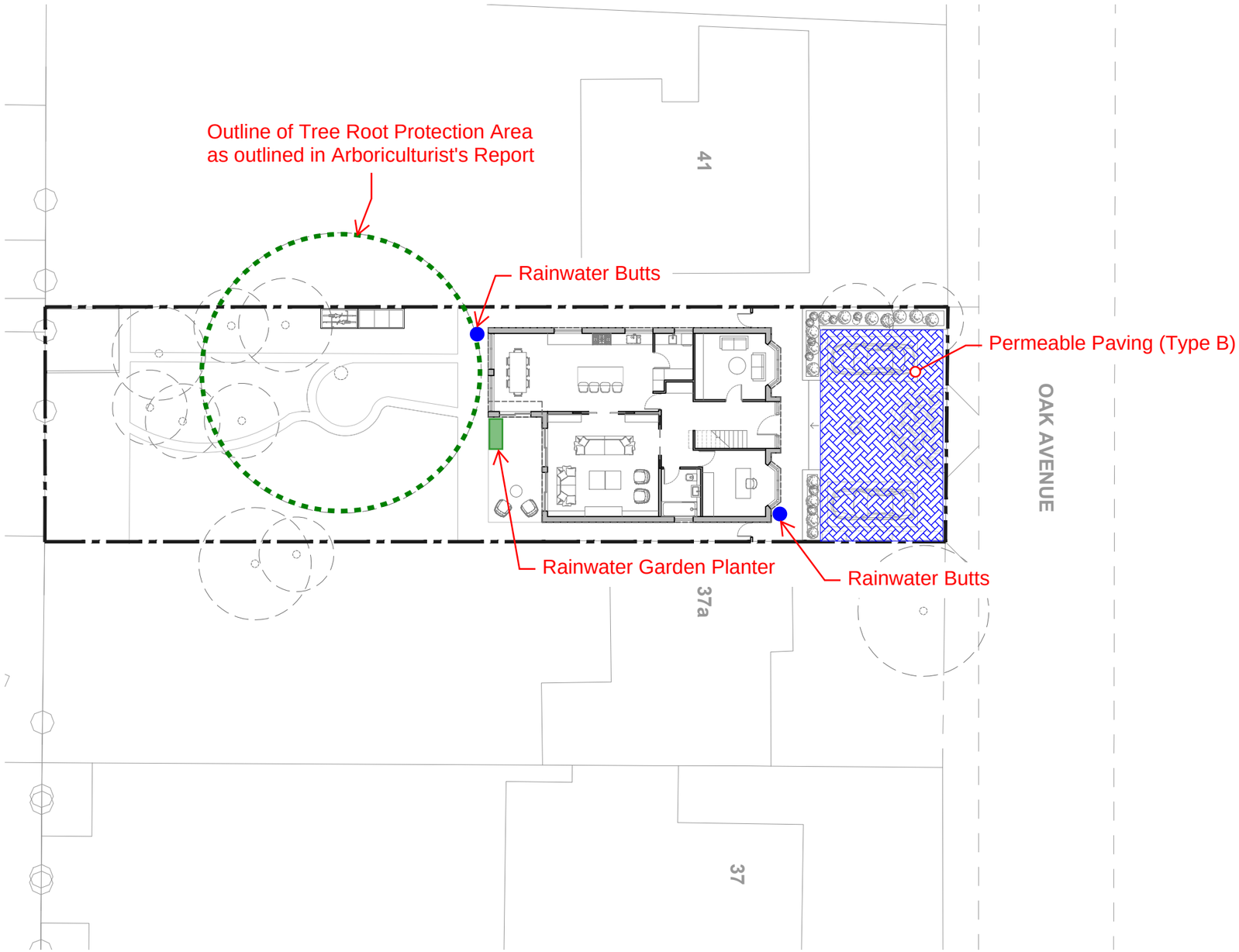
Note:

This report has been prepared for the purposes of submitting for planning to the local planning authority for review in relation to the associated SuDS for the proposed development, and uses the most up-to-date information available to us at the time. It should not be relied upon by anyone else or used for any other purpose. This report is confidential to our Client; it should only be shown to others with their permission. We retain copyright of this report which should only be reproduced with our permission.

	Prepared By	Checked By	Approved for issue
Name	Tom Quigg BSc MSc CEng MICE	Magaly Sedeño BA	Tom Quigg BSc MSc CEng MICE
Signature			
Date	14 July 2022	14 July 2022	14 July 2022

Appendix A - Below Ground Drainage / SuDS Strategy

SuDS Sketch



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Appendix 9: Tree Protection Plan

At this site, operations are to occur in the following sequence:

1. Carry out tree work operations highlighted yellow in the tree data schedule (Appendix 2). All tree works are to be carried out by a competent and experienced arborist to current British Standards (see Appendix 5.9 for assistance finding a suitable arborist).

2. Hold pre-commencement site meeting with project arboriculturist, building contractor and arboricultural officer (prior to the commencement of any development work commencing on site). The contractor will be required to read and sign the induction form (see Appendix 7).

3. Erect protective fencing along the position(s) shown by the dashed red line/s on the TPP.

4. Lay ground protection and/or retain suitably hard-wearing existing hard surfaces within the area(s) shown by the orange honeycombing with blue background on the TPP.

5. Provide a photographic record of all tree protection to arboricultural consultant - this will be forwarded to and approved by the Council's Arboricultural Officer and must demonstrate that all aspects of tree and ground protection measures have been implemented in accordance with this Arboricultural Report. The tree protection measures shall be retained until completion of all works hereby permitted.

6. Demolish existing building.

7. Commence construction.

8. After all heavy construction works have been completed, remove existing hard patio surfacing (by hand).

9. Construct new patio from cellweb or decking (post holes hand-dug and lined with plastic sheeting prior to back-filling with concrete). Gaps of at least 5mm will be left between the deck boards.

10. Remove tree protection when all construction activity has ended.

11. Carry out landscaping works.

Temporary ground protection should be able to support any traffic entering or using the site without being distorted or causing compaction of underlying soil and might comprise one of the following:

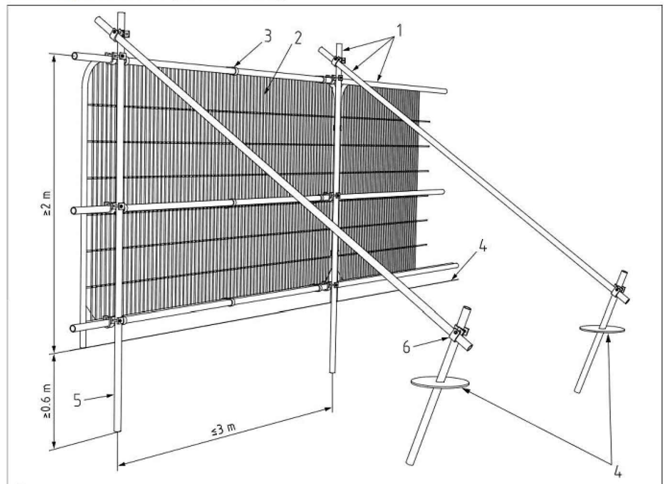
1. For pedestrian-movements only, a single thickness of scaffold boards placed either on top of a driven scaffold frame, to form a suspended walkway, or on top of a compression-resistant layer (e.g. 100 mm depth of woodchip), laid onto a geotextile membrane;

2. For pedestrian-operated plant up to a gross weight of 2 t, proprietary, inter-linked ground protection boards placed on top of a compression-resistant layer (e.g. 150 mm depth of woodchip), laid onto a geotextile membrane;

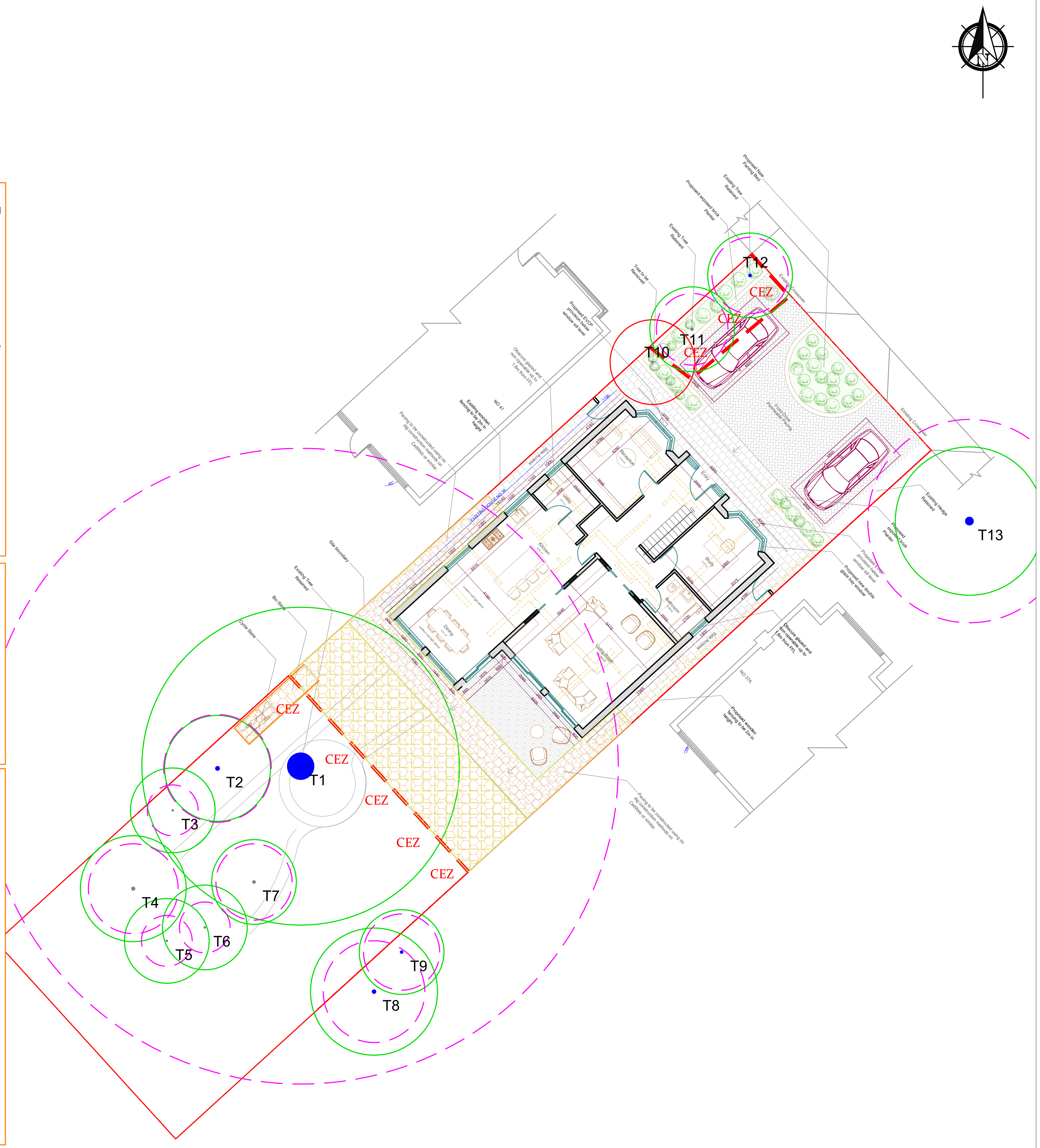
3. For wheeled or tracked construction traffic exceeding 2 t gross weight, an alternative system (e.g. proprietary systems or pre-cast reinforced concrete slabs) to an engineering specification designed in conjunction with arboricultural advice, to accommodate the likely loading to which it will be subjected.

NOTE: If ground protection is to be laid near areas to be excavated, sheet piling should be used to shore up the sides of the excavations prior to being used (by pedestrians or machinery)

Default specification for protective fencing



Key
1 Standard scaffold poles
2 Heavy gauge 2 m tall galvanized tube and welded mesh infill panels
3 Panels secured to uprights and cross-members with wire ties
4 Ground level
5 Uprights driven into the ground until secure (minimum depth 0.6 m)
6 Standard scaffold clamps



Plan Legend

Tree/s to be retained

Tree/s to be removed

Centre colours

Category A Tree

Category B Tree

Category C Tree

Category U Tree

Root Protection Area (RPA) If amended, the original is a dotted blue circle

Protective fencing

CEZ Construction & storage exclusion zone

Existing hard surface retained during works

Existing hard surface retained during works. No-dig, permeable surface afterwards

Scale: 1:200 @ A3 0 4m 8m

Site Address: 39 Oak Avenue Ickenham, UB10 8LR

Client: Amol Varpe

Drawing No: TH/A3/2990C/TPP

Job Ref: TH2990C

Date: 04/07/2022

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End of Report