Granville Road Estate,
London Borough of Barnet

Flood Risk Assessment and Drainage Strategy
August 2014

New Granville LLP

EAS

Document History

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Final 1	For submission	SA	PE	SA	01/07/2014
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1 Introduction

1.1 EAS has been commissioned by the New Granville LLP to prepare a Flood Risk Assessment (FRA) to accompany a planning application for the proposed redevelopment of Granville Road Estate, in Childs Hill, Barnet, London NW2 2LB.

1.2 The proposed development covers an area of 3.72ha and forms the existing Granville Road Estate. The estate is located between Hendon Way and Finchley Road. To the north is Childs Hill Park, to the west are the Golders Green allotments.

1.3 The external areas are largely grassed with areas of hardstanding for paths, car parks and garages. The site location plan is contained in **Appendix A**.

1.4 The redevelopment of the Granville estate includes the retention of Harpenmead, Templewood, Mountfield and Nant Court dwellings, the construction of 135 new homes of mixed tenure and associated parking. A proposed masterplan is included in **Appendix B.**

1.5 The proposals include changes to the existing local roads including providing a link between Llanelly Road and Granville Road allowing local residential traffic to enter and exit Granville Road from the north and from the south.

1.6 The 3.72ha development site is shown to be within Flood Zone 1 of the EA flood maps, however the site is over 1ha and as such a Flood Risk Assessment is therefore required to accompany a planning application to meet the requirements of the National Planning Policy Framework (NPPF).

1.7 This report is based on the Environment Agency Flood Maps, geology mapping, OS mapping, topographic survey, the North London Strategic Flood Risk Assessment, the Draft Barnet Surface Water Management Plan and the NPPF.

1.8 This FRA is set out as follows:

- Section 2 – discusses the pre-application advice provided by the EA.
- Section 3 - outlines current policy guidance and its implications with regards to the development site.
- Section 4 – site description, including site levels, proximity to watercourses etc.
- Section 5 – describes the development proposals.
- Section 6 - outlines potential sources of flooding.
- Section 7 – describes the existing site hydrology and the requirements for the proposed surface water drainage strategy.
- Section 8 – discusses the foul drainage strategy.
- Section 9 – concludes the study.

2 Pre-Application Advice

2.1 A copy of the FRA was sent to the EA for pre-application comment, and a response was sent on the 17 July 2014. The comments are included below and a full copy of the response is included in **Appendix C**.

Thank you for submitting your draft FRA to us for review and provide comments. Having reviewed the FRA we are pleased that you are proposing to restrict the discharge rate of surface water run-off to greenfield rate. This is compliant with the preferred standard of London Plan Policy 5.13.

Despite the positives, it is slightly disappointing that the surface water drainage strategy is so heavily reliant on below ground tanks for attenuation. This attenuation could alternatively be provided by the inclusion of additional Sustainable Drainage System (SuDS) methods in compliance with the hierarchy within London Plan Policy 5.13. These would provide ecological benefits and be easier to maintain when compared to the proposed tanks.

We note that you have made reference to SuDS, and the hierarchy mentioned above, in paragraphs 6.2-6.14 of the FRA. However, we request you carry out more detailed feasibility assessments as to whether more SuDS could be included on the site. If the conclusion of the assessment is that no alternative methods are feasible then evidence and justification as to why attenuation cannot be provided through SuDS should be included within your FRA.

Where possible, green roofs should be included as outlined in policy 5.11 of the London Plan and the Sustainable Design and Construction SPG. Your FRA proposes a significant amount of green roofs which is very positive but it is not clear why more green roofs cannot be provided. If green roofs are not feasible detailed specific justification should be provided for each block/section of the proposed development.

If you amend the drainage scheme to include more SuDS and green roofs or further detailed justification is provided as to why they are not feasible we will be satisfied and have no concerns when consulted on this planning application.

2.2 As a result of the above comments, the following revisions were made to the scheme and FRA, to meet the requirements of the EA:

- Additional swales were added where possible.
- Green roofs on the flat roofed parts of the individual houses were shown on the SuDS plan.
- The addition of a drain-mounted rear garden water butt has been made for each house.
- Comments were included to justify why further open water features and other SuDS features could not be added, as shown below.

2.3 The proposed drainage scheme maximised use of SuDS across the site as far as practicably possible and having regard to all other constraints. In order to ensure that the scheme is acceptable in planning

terms, it is fundamental that the development delivers an appropriate and acceptable quantum and form of private and communal amenity space. An Open Space Assessment accompanies the planning application, which assesses the proposals against the relevant planning policy for Barnet, which provides prescriptive open space standards for development and which in this instance must be applied to both existing and new residents alike. As this report confirms, the proposals do provide an acceptable amount and form of open space, but this position would be undermined if any of this were given over to SuDS which would affect usability of the space provided.

2.4 In accordance with London plan policy, provision of green roofs is maximised across the site, with all flat roofs not required as terraces in order to meet the relevant policy requirements for private amenity space, provided as green roofs. This, together with the provision of swales where possible maximises the use of SuDS across the site in accordance with the SuDS hierarchy and ensures the scheme remains deliverable and acceptable in planning terms.

2.5 Following the reissue of the FRA to the EA, a further pre-application response was sent on the 11 August 2014. The comments are included below and a full copy of the response is also included in **Appendix C**.

Thank you for submitting the revised Flood Risk Assessment to us for comments. Having reviewed the FRA, including the revisions to the Sustainable Drainage Systems (SuDS) strategy dated 5 August we are pleased that our comments in our letter dated 16 July have been taken into consideration.

It is clear that further consideration has been given to the inclusion of SuDS and that paragraphs 7.15-7.17 outline the thought process behind the final SuDS Strategy shown in Appendix L. Although the revised strategy shows a reduction in Green Roof coverage, with the majority of Wildflower Green Roofs replaced with Sedum Green Roof, we acknowledge that this may be necessary to accommodate terraces required for open space. Providing that this justification is accepted by Barnet we feel that the scheme is compliant with Policy 5.11 of the London Plan.

We are pleased that the SuDS strategy has been amended to include a significantly greater area if swales than was proposed in the previous version. I can confirm that if we were consulted by Barnet Planning Authority on the planning application with this Flood Risk Assessment we would respond positively and have no objections on flood risk grounds. The surface water strategy is a very good example of managing surface water using SuDS in an urban setting.

2.6 The wildflower green roofs were revised to sedum not to accommodate terraces but to accommodate PV cells on the new tower blocks and to reduce the maintenance requirements for individual units. Other than this comment, the positive response from the EA demonstrates that the surface water strategy is well considered and has gone above and beyond what would typically be expected of an urban regeneration project.

3 Policy framework

National Policy

3.1 The contents of this FRA are based on the advice set out in The National Planning Policy Framework (NPPF) published March 2012 and the Planning Practice Guidance (PPG), published March 2014.

3.2 The Planning Practice Guidance NPPF Table 1 (Paragraph 065) defines each Flood Zone along with appropriate land use and FRA requirements. The flood risk zones are defined as follows:

- Flood Zone 1 – This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river flooding (<0.1%).
- Flood Zone 2 – This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding.
- Flood Zone 3a – This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), and for tidal flooding at least a 0.5% annual probability of flooding from tidal sources.
- Flood Zone 3b – This zone comprises land where water has to flow or be stored in times of flood.

3.3 A copy of the Environment Agency's Flood Map is included in **Appendix D**. The mapping shows that the site is located entirely within Flood Zone 1 and therefore deemed to be at low risk of fluvial or tidal flooding.

3.4 The Environment Agency state that all uses of land are appropriate in Flood Zone 1, however as the site is over 1ha in area a Flood Risk Assessment is required to accompany a planning application to meet the requirements of the National Planning Policy Framework (NPPF).

3.5 Policy aims in this zone are to seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development and the appropriate application of sustainable drainage systems.

3.6 The above national policy guidance has been taken into account within this site specific FRA, including a proposed SuDS drainage strategy to offer a reduction in the level of flood risk to the local area.

Regional Policy

3.7 The London Plan (July 2011), contains Policy 5.12: Flood Risk Management and Policy 5.13: Sustainable Drainage. These policies are based on the guidance in PPS25 (now superseded by the NPPF). Policy 5.13 notes the importance of SUDS within developments:

"Development should utilise sustainable urban drainage systems (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:

1. *Store rainwater for later use;*
2. *Use infiltration techniques, such as porous surfaces in non-clay areas;*
3. *Attenuate rainwater in ponds or open water features for gradual release;*
4. *Attenuate rainwater by storing in tanks or sealed water features for gradual release;*
5. *Discharge rainwater direct to a watercourse;*
6. *Discharge rainwater to a surface water sewer/drain;*
7. *Discharge rainwater to the combined sewer.*

Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation."

3.8 The surface water drainage design set out in this FRA will demonstrate that the proposed redevelopment will be consistent with The London Plan, specifically Policies 5.12 and 5.13.

Local Policy

3.9 The London Borough of Barnet has completed their Local Development Framework for the borough, and the Local Plan: Core Strategy adopted September 2012 sets out the long term strategy for Barnet to guide development and use of land. Core Strategy Policy CS13 sets out the Council's aims regarding flood risk and development:

Policy CS 13: Ensuring the efficient use of natural resources:

We will make Barnet a water efficient Borough and minimise the potential for fluvial and surface flooding by ensuring development does not cause harm to the water environment, water quality and drainage systems subject to local geology and ground water levels. Development should utilise Sustainable Urban Drainage Systems (SUDS) in order to reduce surface water run-off and ensure such run-off is managed as close to its source as possible.

3.10 The London Borough of Barnet has also adopted the Barnet Local Plan: Development Management Policy (September 2012) which sets out the spatial planning for Barnet. Development Management Policy DM04 sets out the Council's aims regarding flood risk, sustainability and development:

Policy DM04: Environmental considerations for development:

.. Development should demonstrate compliance with the London Plan water hierarchy for run off especially in areas identified as prone to flooding from surface water run-off. All new development in areas at risk from fluvial flooding must demonstrate application of the sequential approach set out in the NPPF (paras 100 to 104) and provide information on the known flood risk potential of the application site.

3.11 The flood risk management measures discussed within this report will demonstrate that the proposed redevelopment will be consistent with the Local Plan (Core Strategy and Development Management Policy) for the borough.

Strategic Flood Risk Assessment

3.12 The North London Strategic Flood Risk Assessment (SFRA) was published in August 2008 and was produced jointly with London Boroughs Barnet, Enfield, Hackney, Haringey, Waltham Forest, Camden and Islington.The report outlines the various flood risk issues faced by the Boroughs that need to be considered when assessing new developments and allocating potential development sites.

3.13 The following figures/extracts from the SFRA are included in **Appendix E** of this report:

- Map 8 – Flood Risk Zone Map
- Map 12 – Groundwater Contours
- Map 13 – Postcode Flooding Map
- Map 20 – Flooding Incidents

3.14 Map 8 shows the fluvial flood risk zones based on the EA fluvial flood map; the map confirms that the development site is deemed to be at a low risk of flooding from rivers and sea, with an annual probability of under 0.1%, and is therefore in Flood Zone 1.

3.15 Map 12 shows the depth of groundwater contours. It can be seen that groundwater is located 60m below ground levels in the vicinity of the site. As such the risk of groundwater flooding is expected to be low.

3.16 Map 13 illustrates the number of flood events recorded from Thames Water sewer flooding records based on postcode areas. The area which includes the development area is highlighted as having one event occurring. No further detail of this flooding event is provided in the SFRA.

3.17 Map 20 shows Flooding Incidents recorded throughout the 7 boroughs from a number of sources including Barnet Council, TfL, Fire Services, and Emergency Planning Services. There are no incidents illustrated within the site or in close proximity to the site.

3.18 It can be concluded that there is only a history of a single surface water flooding event picked up within the SFRA as having occurred within the local area which contains the proposed development site; however the details of this event are not known.

3.19 The SFRA refers to The London Plan and NPPF for recommendations for reducing flood risk through sustainable drainage systems (SuDS). It is clear that the development site should accommodate a SuDS drainage system, these recommendations have been taken into account in the proposed drainage strategy set out in this FRA.

Barnet Surface Water Management Plan (SWMP)

3.20 The SWMP for the London Borough of Barnet is part of the 'Drain London Project'. The document outlines the preferred surface water management strategy for the London Borough of Barnet and includes consideration of flooding from sewers, drains, groundwater and runoff from land, small watercourses and ditches that occurs as a result of heavy rainfall. The document has not been published

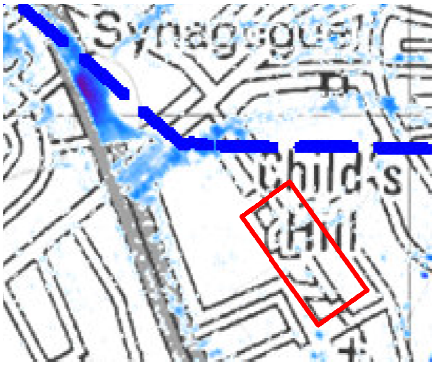
for public use and the information below is based on the draft document and figures provided by Barnet Council for information only.

3.21 To ascertain a more accurate understanding of the surface water flood risk and hazard across the borough including for ordinary watercourses not covered by the EA Flood Mapping for main watercourse, hydraulic modelling was undertaken for the borough using TUFLOW. TUFLOW is a hydrodynamic modelling package which has been used for 2D modelling.

3.22 The site is shown in the SWMP to be located within the Childs Hill Critical Drainage Area (CDA). A CDA is defined in the SWMP as: *CDA units are larger than LFRZs* (Local Flood Risk Zones) *and denote an area or catchment where mitigation measures may be implemented to reduce flooding experienced in the flood risk zone. The CDA comprises the upstream 'contributing' catchment, the influencing drainage catchments, surface water catchments and, where appropriate, a downstream area if this can have an influence on the LFRZ. CDA units should be used for site specific detailed planning and capital works schemes and may contain one or more LFRZs.*

3.23 The following summary of the flood risk within the CDA is provided in the SWMP: *The main source of flood risk in this CDA is overland flow between the open channel Sections of the Clitterhouse Stream. There are several overland flow paths which follow topographical lows through the residential areas in this CDA. There are also several areas of ponded flow upstream of culverted Sections of the Stream and at constriction points through structures. Three LFRZs have been designated within this CDA; these cover the areas at most significant risk from surface water flooding. The mapping within this CDA has been validated with both the EA FMfSW and historical flood incident records.*

3.24 The site is shown to be located outside of but just to the south of a LFRZ and this is due to the presence of the culverted Clitterhouse Stream which runs across the southern and eastern boundaries of the Childs Hill Park, approximately 25m to the north of the site boundary. SWMP Figure D-15 illustrates the 100 year plus climate change surface water flood modelling results, and SWMP Figure D-16 illustrates the 100 year plus climate change surface water hazard modelling results. An extract of each of these figures is included below including the approximate site boundary denoted by the red boundary line:



Extract of Figure D-15 100 Year plus climate change Surface Water Flood Modelling

Extract of Figure D-16 100 Year plus climate change Surface Water Flood Hazard

3.25 It can clearly be seen that the redevelopment site is to the south of the area at a high risk of surface water flooding from the culverted Clitterhouse Stream, with only very small areas of possible surface water ponding shown within the site boundary, and a resultant low hazard rating for these areas. The site does not fall within the areas which are shown to be at a high risk of surface water flooding as a result of the local topography which falls away from the site and towards the stream.

3.26 SWMP Figure D-4 illustrates the EA Flood Map overlaid with fluvial flooding incidents. No history of fluvial flooding is illustrated within the Childs Hill area.

3.27 The SWMP also provides a summary of the preferred option for dealing with the identified flood risk, as provided below:

To mitigate the flood risk in this area, the following preferred option has been derived. To reduce the amount of ponding water, a series of swale systems and detention basins are proposed in the north west of the CDA. Figure E3-3 below outlines the proposed locations of the two swales and two detention basins within this CDA.

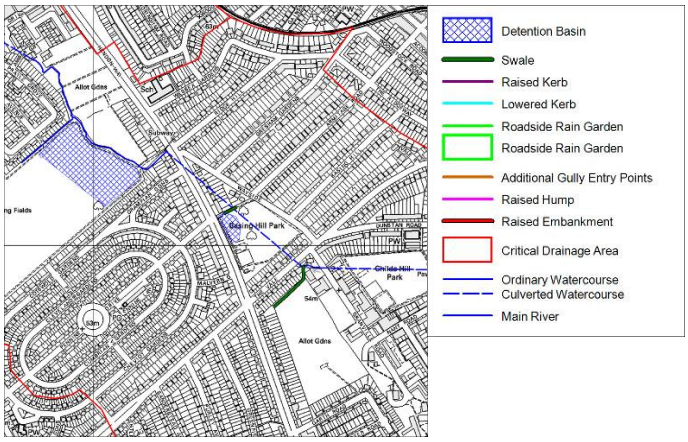


Figure E3-3 Childs Hill Preferred Option Locations

….The proposed detention basins and swale systems would help to reduce localised surface water ponding and fluvial flood risk at Prayle Grove, Amber Grove and Marble Drive. It would also have benefits to areas further up the Clitterhouse Stream as the culverted system will have more capacity as surface water runoff will be entering the system at a slower rate. This option will not completely eliminate the risk posed to property but it should mitigate the risks. This option is predominantly focused on reducing the deeper areas of ponding within the CDA.

Further investigation should be made in Childs Hill Park to assess the possibility of localised land lowering within the park to create an additional offline storage area which would only be used in extreme events.

3.28 Should the proposed drainage improvement option above be implemented in the future, the proposals would not impact on the development site other than reducing the risk of flooding in the local area. It is clear however that the proposed surface water drainage strategy for the site as set out within this FRA should aim to reduce the current level of surface water runoff from the site, to reduce flood risk downstream of the site within the LFRZ and wider CDA.

4 Site Description

4.1 The proposed development covers an area of 3.72ha and forms the existing Granville Road Estate. The estate is located between Hendon Way and Finchley Road. To the north is Childs Hill Park, to the west are the Golders Green allotments.

4.2 The external areas are largely grassed with areas of hardstanding for paths, car parks and garages. The site location plan is shown in **Appendix A**.

Site Levels

4.3 The site is nominally 400m long by 100m in width, and slopes from south to north. A detailed topographic survey is enclosed in **Appendix F**, which shows all levels relative to OS datum. External ground levels within the site range between approximately 55.6mAOD at the northern boundary to 69.3m at the southern boundary.

Geology

4.4 The interactive map on the British Geological Survey website indicates that the site is founded on London Clay Formation. No recorded superficial deposits have been recorded at the site. It is not therefore anticipated that the site geology will be suitable for infiltration methods to be utilised to discharge surface water run-off, given the highly impermeable nature of London Clay.

Proximity to Watercourses

4.5 The closest main watercourse is the River Brent which is 1.8km to the north west of the site. The closest ordinary watercourse is the Clitterhouse Stream which runs across the southern and eastern boundaries of the Childs Hill Park, approximately 25m to the north of the site boundary. The watercourse is culverted along the boundary of the Childs Hill Park.

4.6 Public sewer records from Thames Water are contained in **Appendix G**. The culverted section of the Clitterhouse Stream can be seen which is confirmed to be 1200mm in diameter. In addition it can be seen that a 300mm surface water sewer and 225mm sewer run the length of Granville Road through the centre of the Estate.

Existing Surface Water Drainage

4.7 The existing development at the site has a formal gravity surface water drainage system, with the 300mmThames Water surface water sewer located within Granville Road picking up the rainwater downpipes from the buildings, and connections from the gullies and linear drains present within the hardstandings. There does not appear to be any restrictions on the discharge rate of surface water runoff

(other than the size of the sewer connections).

4.8 Sketch SK01 in **Appendix H** illustrates the existing impermeable areas on site classified as summarised below:

- Existing Roof Areas: 0.428ha
- Existing Hardstandings: 1.232ha
- Total Impermeable Area= 1.660ha
- Total Greenfield Area=2.040ha
- Total Area=3.72ha

4.9 The existing level of surface water runoff from the development site is a combination of the runoff from the brownfield built area collected in the gravity drainage system, and the greenfield runoff. Based on the impermeable area and an assumption that the drainage system is likely to be designed to accommodate the commonly adopted rainfall intensity of 50mm/hr, the total brownfield runoff rate from the site is currently expected to be 230l/s (50mm/hr / 3600 x 16,600sqm).

4.10 Greenfield runoff rates calculations have been carried out using the ICP SUDS Mean Annual Flood function on the WinDes Micro software and are provided in **Appendix I**. Greenfield runoff rates for 1 year, 30 year and 100 year events are summarised below for the total current greenfield area of 2.040ha:

- 1 Year – 3.72 l/s/ha – 7.6 l/s
- 30 Year – 9.9 l/s/ha – 20.2 l/s
- 100 Year – 14.0 l/s/ha – 28.6 l/s

4.11 The combined surface water runoff rate for the brownfield and greenfield areas (based on the combination of the design rainfall intensity for the brownfield areas and the 100 year rainfall event for greenfield areas) is 258 l/s.

4.12 The above is for information only. It should be noted that the proposed surface water drainage strategy within this FRA aims to restrict runoff from the development site to greenfield runoff rates for the whole site area and as such significantly reduce the current volume of surface water entering the Thames Water system including the culverted Clitterhouse Stream.

5 Development Proposals

5.1 The main Masterplan drawings of the proposed redevelopment are included in Appendix C. These show the proposed mixed use development consisting of:

- Existing Granville, Harpenmead, Templewood, Mountfield and Nant Court dwellings;
- 135 new homes of mixed tenure including 58 houses and 77 flats;
- A new vehicle access arrangement with a revised junction between Granville Road and Nant Road and a new road link between Granville Road and Llanelly Road;
- 196 allocated parking spaces for existing residents;
- 137 allocated parking spaces for new residents including two underground parking areas;
- Cycle and motorcycle parking; and
- Two car club spaces.

5.2 Of the 135 new dwellings there will be:

- 30 one bed flats of which two will be wheelchair accessible;
- 47 two bed flats of which eight will be wheelchair accessible;
- 2 two bed wheelchair accessible houses;
- 26 three bed houses of which two will be wheelchair accessible; and
- 30 four bed houses.

5.3 The new build properties are arranged into houses accessed from Mortimer Close and the remainder along Granville Road. There will be three new flat blocks:

- The Court, replacing Beech Court, with 40 new 1 and 2 bed apartments including 4 wheelchair accessible and an underground car park;
- The Square opposite Harpenmead, with 34 new 1 and 2 bed apartments including 6 wheelchair accessible and an underground car park; and
- The Gateway alongside Nant Court with 3 new 1 and 2 bed apartments.

5.4 The replacement of Beech Court with The Court will result in a loss of 21 existing flats.

5.5 The proposed roof areas and hardstanding areas as measured from the masterplan are identified below. These areas include any green roof areas and permeable paved areas as they are required to be included within the drainage calculations:

- Proposed Roof Areas: 0.6ha (including 0.02ha of green roof area)
- Proposed Hardstandings: 1.6ha (including 0.27ha of permeable paving)
- Total Built Area= 2.2ha

6 Potential Sources of Flooding

Fluvial & Surface Water

6.1 A copy of a site specific detailed Flood Map issued by the Environment Agency is included in **Appendix D**. The mapping shows that the entirety of the site is located within Flood Zone 1, this zone comprises land assessed as having a less than 1 in 1,000 annual probability of river flooding (<0.1%). The site is therefore deemed to be at a low risk of flooding from a main river.

6.2 The site has been shown to fall within the Childs Hill Critical Drainage Area (CDA) as identified within the Barnet SWMP; however the site is shown to be located outside of but just to the south of a local flood risk zone (LFRZ). This is due to the presence of the culverted Clitterhouse Stream which runs across the southern and eastern boundaries of the Childs Hill Park, approximately 25m to the north of the site boundary. Due to the stream being culverted and forming part of the wider sewer network the flood risk is defined as both fluvial (river) and surface water flooding.

6.3 Surface water flooding is caused when the intensity of rainfall, particularly in urban areas, can create runoff which temporarily overwhelms the capacity of the local drainage systems. A review of the SWMP Figure D-15, which illustrates the critical 100 year plus climate change surface water flood modelling results, indicates that the redevelopment site is to the south of the high risk area. This is a result of the local topography which falls away from the site and towards the stream. Only some small areas of possible surface water ponding are illustrated and as such the overall surface water flood risk is deemed to be low.

6.4 Reference to the surface water flood risk maps on the EA website (reproduced at **Appendix J**) shows that most of the site is considered to have a 'Very Low' risk, with some very small areas contained to the highway susceptible to a low to medium risk of pluvial flooding. The mapping therefore confirms the findings of the Barnet SWMP.

6.5 The SWMP includes some drainage improvements which could be implemented to reduce the flood risk in the CDA. Should the proposed drainage improvement option above be implemented in the future, the proposals would not impact on the development site other than reducing the risk of flooding in the local area.

6.6 In summary it the site falls within a CDA as a result of the proximity to the culverted Clitterhouse Stream which has shown to be at risk of flooding, however there is no historic fluvial flood risk and a low modelled risk of surface water flooding within the site boundary. As such the fluvial and surface water risk is defined to be low. However it is clear that should the level of surface water runoff from the site be reduced from the current level, that this will reduce the volume of water discharging to the culverted Clitterhouse Stream, and as a result reduce the flood risk downstream of the site. Therefore it is proposed that the redevelopment aims to meet greenfield runoff rates as part of the SuDS drainage

strategy, as set out in Section 6 of this report.

Groundwater

6.7 There are no known records of the site flooding from a groundwater source, and the impermeable nature of London Clay and identified depth of the water table (circa 60m) makes groundwater flooding unlikely to be a significant issue at the site. Therefore the risk of flooding from groundwater is deemed to be low.

Sewer

6.8 The adopted surface and foul water sewers within the site are likely to be rerouted and potentially resized as part of the redevelopment proposals, in addition to the current level of surface water runoff being reduced as set out in the surface water drainage strategy in the next section of this report. As such the localised risk of flooding from sewers is expected to be low.

Climate Change

6.9 Based on the most recent advice on climate change reported in Table 5 of the NPPF Technical Guidance, peak rainfall intensity, sea level, peak river flow, offshore wind speed and extreme wave heights are all expected to increase in the future. The NPPF recommends that considerations for future climate change are included in Flood Risk Assessments for proposed developments.

6.10 The site is likely to be subject to increases in rainfall intensity of 30% over the lifetime of the development that will place additional pressure on surface water drainage infrastructure. Therefore, the drainage systems that will serve the proposed development should be designed to cater for a 100 year plus 30% rainfall event.

7 Proposed SuDS Strategy

7.1 The proposed surface water drainage strategy should take account of the use of SuDS techniques within the existing constraints, and where SuDS techniques are not possible, the drainage will need to be designed to ensure that the flood risk is not increased elsewhere. The reason for this is that, if the rate of surface water discharged from the site was to increase, the flood risk to both the site and the surrounding area could potentially be increased during heavy rainfall events. This is particularly important given the site is located in a Critical Drainage Area.

7.2 The London Plan (2011) Policy 5.13, lists the following hierarchy for drainage design:

1. *Store rainwater for later use;*
2. *Use infiltration techniques, such as porous surfaces in non-clay areas;*
3. *Attenuate rainwater in ponds or open water features for gradual release;*
4. *Attenuate rainwater by storing in tanks or sealed water features for gradual release;*
5. *Discharge rainwater direct to a watercourse;*
6. *Discharge rainwater to a surface water sewer/drain;*
7. *Discharge rainwater to the combined sewer.*

7.3 As previously mentioned, the site geology bedrock of London Clay is unlikely to be conducive to infiltration methods. As such, other methods have been investigated for the site.

7.4 The runoff from the site must not exceed that prior to the redevelopment i.e. the brownfield runoff rate. However, given the site is located within a Critical Drainage Area, it is recommended that the runoff from the proposed development is attenuated to the calculated greenfield runoff rate.

7.5 The Quick Storage Estimate function in the Microdrainage Software has been used to calculate the required attenuation storage to reduce the runoff to greenfield levels, based on the following assumptions:

- A total site area of 3.72ha.
- A proposed roof and hardstanding built area of 2.2ha.
- A greenfield discharge rate of 14 l/s/ha.
- An allowable discharge rate of 30.8 l/s (2.2ha x 14 l/s/ha)
- A return period of 100 years.
- An allowance for climate change of up to 30%.

7.6 Based on these assumptions a required attenuation volume between the range of 938-1265m^3 has been calculated. Details of the runoff calculations are included in **Appendix K**. This total volume of attenuation storage is proposed to be split across the site in a number of SuDS features as discussed below.

7.7 The restriction in runoff rates will result in a reduction from the estimated runoff rate for the current site layout of 258l/s (see Section 3) to a greenfield runoff rate of 52l/s (14 l/s x 3.68). A total reduction in surface water runoff from the site of 208l/s.

SuDS Sequential Test / Selection

7.8 The SuDS management train incorporates a hierarchy of techniques and considers all three SUDS criteria of flood reduction, pollution reduction, and landscape and wildlife benefit. In decreasing order of preference, the preferred means of disposal of surface water runoff is:

- Discharge to ground.
- Discharge to a surface water body.
- Discharge to a surface water sewer.
- Discharge to a combined sewer.

7.9 The philosophy of SuDS is to replicate as closely as possible the natural drainage from a site pre-development and to treat runoff to remove pollutants, resulting in a reduced impact on the receiving watercourses. The benefits of this approach are as follows:

- Reducing runoff rates, thus reducing the flood risk downstream.
- Reducing pollutant concentrations, thus protecting the quality of the receiving water body.
- Groundwater recharge.
- Contributing to the enhanced amenity and aesthetic value of development areas.
- Providing habitats for wildlife in developed areas, and opportunity for biodiversity enhancement.

7.10 The various SuDS methods need to be considered in relation to site-specific constraints. Several SuDS options are available to reduce or temporarily hold back the discharge of surface water runoff. Table 1 outlines the constraints and opportunities to each of the SuDS devices in accordance with the hierarchical approach outlined in The SuDS Manual CIRIA C697i. It also indicates what could and could not be incorporated within the development, based upon site-specific criteria.

Device	Description	Constraints / Comments	Appropriate
Green-roofs	Provide soft landscaping at roof level which reduces surface water runoff.	Areas of sedum and intensive wildflower green-roofs have been provided where they are possible taking into account other design constraints.	Yes
Infiltration devices & Soakaways (source control)	Store runoff and allow water to percolate into the ground via natural infiltration.	The underlying geology prevents infiltration devices being used.	No
Pervious surfaces (source control)	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate and/or slowly release to sewers.	It is proposed that permeable surfacing is used on the majority of car parking spaces with attenuation storage within the sub-base.	Yes
Rainwater harvesting (source control)	Reduces the annual average rate of runoff from the Site by reusing water for non-potable uses e.g. toilet flushing, recycling processes.	Potential for rainwater to be reused in the future for irrigation, however this has not formed part of the SuDS strategy at this stage.	Yes
Swales (permeable conveyance)	Broad shallow channels that convey / store runoff, and allow infiltration (ground conditions permitting).	A small number of swales have been proposed across the site, however this has had a limited application due to the urban nature of the development site.	Yes
Filter drains & perforated pipes (permeable conveyance)	Trenches filled with granular materials (which are designed to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration.	The underlying geology is unlikely to have potential for infiltration.	No
Filter Strips (permeable conveyance)	Wide gently sloping areas of grass or dense vegetation that remove pollutants from run-off from adjacent areas.	Unlikely to be suitable for this type of urban housing development.	No
Infiltration basins (end of pipe treatment)	Depressions in the surface designed to store runoff and allow infiltration.	The underlying geology is unlikely to have potential for infiltration.	No
Wet ponds & constructed wetlands (end of pipe treatment)	Provide water quality treatment & temporary storage above the permanent water level.	Other than the swales proposed large open water features will not be possible within the site due to the urban nature of the residential development, and restricted space.	Yes
Attenuation Underground (end of pipe treatment)	Oversized pipes or geo-cellular tanks designed to store water below ground level.	A significant volume of underground attenuation storage is proposed in order to restrict runoff to as close as possible to greenfield runoff rates, where other SuDS options are not available.	Yes

Table 1: Site-Specific Sustainable Drainage Techniques

7.11 It can be seen that the SuDS techniques that have been selected for the site meet all three SuDS criteria

of flood reduction, pollution reduction and landscape and wildlife benefit; whilst also meeting the requirement for attenuation storage.

7.12 A drainage strategy drawing prepared by Levitt Bernstein is contained in **Appendix L**. The SuDS plan illustrates each of the features identified in Table 1. It can be seen that there is an even spread of attenuation storage available across the site within the permeable paving, swales, and attenuation tanks. This will result in a reduction in the surface water flood risk to each part of the system under extreme rainfall conditions.

7.13 There will be a requirement for a control in the form of an orifice plate, or more likely a vortex control to be placed at the outfall of each of the larger attenuation features in order to restrict the flow to greenfield runoff rates. The details of these control chambers will be provided at a later stage as part of the detailed design of the surface water network.

7.14 In summary the surface water drainage strategy will result in a significant reduction in the amount of surface water runoff leaving the site from 258l/s to a greenfield runoff rate of 52l/s. This is achieved by a combination of SuDS techniques spread evenly across the site that meet all three SuDS criteria. As such in addition to meeting current best practice, the proposed surface water drainage system will result in a reduction in the flood risk downstream of the site; and reduce the overall flood risk within the CDA.

7.15 The proposed drainage scheme has maximised use of SuDS across the site as far as practicably possible and having regard to all other constraints. In order to ensure that the scheme is acceptable in planning terms, it is fundamental that the development delivers an appropriate and acceptable quantum and form of private and communal amenity space. An Open Space Assessment accompanies the planning application, which assesses the proposals against the relevant planning policy for Barnet, which provides prescriptive open space standards for development and which in this instance must be applied to both existing and new residents alike. As this report confirms, the proposals do provide an acceptable amount and form of open space, but this position would be undermined if any of this were given over to SuDS which would affect usability of the space provided.

7.16 In accordance with London plan policy, provision of green roofs is maximised across the site, with all flat roofs not required as terraces in order to meet the relevant policy requirements for private amenity space, provided as green roofs. This, together with the provision of swales where possible maximises the use of SuDS across the site in accordance with the SuDS hierarchy and ensures the scheme remains deliverable and acceptable in planning terms.

It has been confirmed by the EA in the pre-application response to the submission of this FRA/Drainage Statement that*: We are pleased that the SuDS strategy has been amended to include a significantly greater area if swales than was proposed in the previous version. I can confirm that if we were consulted by Barnet Planning Authority on the planning application with this Flood Risk Assessment we would respond positively and have no objections on flood risk grounds. The surface water strategy is a very good example of managing surface water using SuDS in an urban setting.*

Maintenance of Development Drainage

7.17 It is proposed that other than the green-roofs and the private sewers, the main sewers, and all other SuDS features will be offered up for adoption to Thames Water. Early discussion with Thames Water is recommended to determine what features can be adopted and what may be required to remain private. The approval of the drainage strategy after April 2014 may be required to be secured via the local SuDS Approving Body (SAB) under the Flood and Water Management Act 2010.

7.18 It is proposed that the maintenance of any private sewers and the green roofs will be through a management company. As such the freehold owners of each property would be required to contribute to the upkeep.

Notes on Attenuation Calculations

7.19 The areas of each of the drainage features illustrated on the SuDS plan contained in **Appendix L**, and the resultant attenuation volumes have been calculated based on the following assumptions, which may be subject to change at a detailed design stage:

- Green Roofs 1980sqm – not included in the attenuation calculation; as depending on the system the likely storage may not be able to cope with the critical 100 year plus climate change event. It is likely however that some storage will be available and as such the calculations are robust.
- Swales 300sqm – storage calculated on the basis of 0.5m^3 of attenuation storage available for every sqm of swale. This allows for sloped sides of the swales. Total volume 150m^3.
- Permeable paved areas 2,700sqm – 0.14m^3 of storage per sqm, based on 0.4m depth of single size granular sub-base with one third of volume made up of voids. Total volume 378m^3.
- Attenuation tanks 1,013sqm- an average of 1.5m^3 of storage per sqm within the tanks. Total volume 1520m^3.

7.20 It can be seen that the total available storage volume of 2048m^3, is significantly higher than the required total attenuation of 938-1265m^3. As such at a detailed design stage it is likely that a reduction will be possible in the amount of surface water storage provided on site. It is also possible that the location of the drainage features may need to be relocated depending on the final layout and drainage requirements.

7.21 It can therefore be seen that a robust approach has been taken to the calculation of the available attenuation storage volume within the surface water system.

8 Foul Drainage Strategy

8.1 Foul Water will outfall to the Thames Water adopted network via existing and new private sewer connections following agreement with Thames Water.

8.2 At this early stage an initial capacity check on the main 225mm (diameter) foul sewer within the development site has been undertaken to assess the likelihood of capacity being available within the sewer. Please note that this is not a full capacity check which will be undertaken by Thames Water post planning.

8.3 A calculation of the peak foul flow rate in the existing sewer was undertaken by assessing the flow to each of the manholes along the sewer using rates as derived in Sewers for Adoption 7th Edition and BS EN 752. The resultant flow in the sewer was identified to have a peak flow rate of 22.69l/s.

8.4 The Thames Water sewer records show the foul water sewer is between 3m and 4m deep with gradients ranging between 1:100 to 1:24. A design check using the industry standard programme WINDES confirms the capacity for a 225mm foul water pipe laid at 1:100 is 45.6 l/s.

8.5 It is proposed to provide an additional 135 dwellings, and based on 4000 litres per day per dwelling (taken from Sewers for Adoption) equates to 6.25 l/s. The total peak flow within the existing pipe was calculated to be 22.69 l/s, plus the proposed new dwellings this is therefore likely to increase to 28.95l/s.

8.6 It can be seen that the predicted flow rate of 28.95 l/s can be accommodated within a 225mm sewer laid at 1:100, and as it is more likely that the average gradient is around 1:40 this a robust calculation

8.7 Should the sewer be required to be diverted within the site it is likely therefore that a 225mm sewer could replace the existing sewer.

8.8 It should be noted that as the highway within the site will become private that an easement agreement will need to be put in place with Thames Water in order that access can be retained to the foul water sewer (and surface water sewer).

8.9 Details of the foul water drainage design will be confirmed at a detailed design stage.

9 Conclusions and Recommendations

9.1 The 3.72ha development site is shown to be within Flood Zone 1 of the EA flood maps, however the site is over 1ha and as such a Flood Risk Assessment is required to accompany a planning application to meet the requirements of the National Planning Policy Framework (NPPF) and the Planning Practice Guidance.

9.2 The site has been shown to fall within the Childs Hill Critical Drainage Area (CDA) as identified within the Barnet SWMP. This is a result of the proximity of the site to the culverted Clitterhouse Stream which has shown to be at risk of flooding; however there is no historic fluvial flood risk identified within the SWMP and a low risk of surface water flooding modelled within the site boundary. As such the fluvial and surface water risk is defined to be low.

9.3 The surface water drainage strategy will result in a significant reduction in the amount of surface water runoff leaving the site from an estimated 258l/s, to a greenfield runoff rate of 52l/s. This is achieved by a combination of SuDS techniques spread evenly across the site that meet all three SuDS criteria. As such in addition to meeting current best practice, the proposed surface water drainage system will result in a reduction in the flood risk downstream of the site; and reduce the overall flood risk within the CDA.

9.4 The proposed SuDS strategy meets the requirements of the London Plan (2011), Barnet Core Strategy Policy CS13, and Barnet Development Management Policy DM04.

9.5 **We believe that the development proposals comply with the guidance provided in the NPPF and that no reason exists to object to the proposals in terms of flood risk.**

10 Appendices

Appendix: A	Location Plan
Appendix: B	Proposed Masterplan
Appendix: C	EA Pre-application Advice
Appendix: D	EA Flood Map
Appendix: E	SFRA Maps
Appendix: F	Topographical Survey
Appendix: G	Thames Water Sewer Map
Appendix: H	Existing Impermeable Areas
Appendix: I	Greenfield Runoff Calculations
Appendix: J	EA Surface Water Flood Map
Appendix: K	Attenuation Calculations
Appendix: L	SuDS Strategy

Appendix: A LOCATION PLAN

KEY:

DEVELOPMENT SITE

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS:

EAS

Unit 108, The Maltings, Stanstead Abbotts, Hertfordshire, SG12 8HG
Tel: 01920 871777

www.eastp.co.uk

CLIENT:

GRANVILLE ROAD LLP

ARCHITECT:

PROJECT:

BARNET

GRANVILLE ROAD

TITLE:

LOCATION PLAN

SCALE @ A3:	DESIGN–DRAWN:	DATE:
NTS	CD	15/07/2013

PROJECT No:	DRAWING No:
237	FRA FIGURE 01

Appendix: B PROPOSED MASTERPLAN

1 - Sub Station
2 - Refuse Store
3 - Recyle Store
4 - Pram Shed
5 - Bike Store
6 - Basement escape

0 5m 10m 15m 20m

standard notes

1. Do not scale this drawing.
2. All dimensions must be checked on site and any discrepancies verified with the architect.
3. Unless shown otherwise, all dimensions are to structural surfaces.

THIS IS NOT A CONSTRUCTION DRAWING, IT IS UNSUITABLE FOR THE PURPOSE OF CONSTRUCTION AND MUST ON NO ACCOUNT BE USED AS SUCH.

drawing notes

revisions

P1: Highways issue for vehicle tracking
P2: 30.4.2014 Draft Masterplan Issue
P3 21.05.2014 Issue to Highways Department
P4 04.06.2014 Issue for provisional costing
P5 17.06.2014 Issue to traffic consultant
P6 18.06.2014 Issue for costing
P7 23.06.2014 Issue to client
P8 26.06.2014 Planning Issue
P9 14.08.2014 Final Planning Issue

Granville Road

new granville

London Borough of Barnet

date 16/4/2014

client New Granville LLP

scale 1 : 500 @A1

drawing Landscape Masterplan

drawn BT **checked** GT **drawing number** 2928A - L - D_901 **rev** P9

C:\Users\amy.strong\Documents\2928A_GRANVILLE_Proposed_Landscape_CENTRAL_2015_amystrong.rvt

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Levitt Bernstein

Appendix: C EA PRE-APPLICATION ADVICE

creating a better place

Environment Agency

Stephen Adams
EAS
Via email
stephen.adams@eastp.co.uk

Our ref: NE/2014/120586/04-L01
Your ref:

Date: 11 August 2014

Dear Stephen

Draft FRA for a proposed redevelopment and regeneration at the Granville Road Estate, Barnet.

Document reviewed: Granville Road FRA Job Number: 237

Thank you for submitting the revised Flood Risk Assessment to us for comments. Having reviewed the FRA, including the revisions to the Sustainable Drainage Systems (SuDS) strategy dated 5 August we are pleased that our comments in our letter dated 16 July have been taken into consideration.

It is clear that further consideration has been given to the inclusion of SuDS and that paragraphs 7.15-7.17 outline the thought process behind the final SuDS Strategy shown in Appendix L. Although the revised strategy shows a reduction in Green Roof coverage, with the majority of Wildflower Green Roofs replaced with Sedum Green Roof, we acknowledge that this may be necessary to accommodate terraces required for open space. Providing that this justification is accepted by Barnet we feel that the scheme is compliant with Policy 5.11 of the London Plan.

We are pleased that the SuDS strategy has been amended to include a significantly greater area if swales than was proposed in the previous version. I can confirm that if we were consulted by Barnet Planning Authority on the planning application with this Flood Risk Assessment we would respond positively and have no objections on flood risk grounds. The surface water strategy is a very good example of managing surface water using SuDS in an urban setting.

I hope that these comments are helpful but please contact me if you have any queries.

Yours sincerely

Ben Llewellyn
Planning Advisor
Direct dial 0203 263 8056
Direct e-mail northlondonplanning@environment-agency.gov.uk

creating a better place

Environment Agency

Stephen Adams
EAS
Via email
stephen.adams@eastp.co.uk

Our ref: NE/2014/120586/03-L01

Date: 17 July 2014

Dear Stephen

Draft Flood Risk Assessment (FRA) for a proposed redevelopment and regeneration at the Granville Road Estate, Barnet.

Document reviewed: Granville Road FRA Job Number: 237

Thank you for submitting your draft FRA to us for review and provide comments. Having reviewed the FRA we are pleased that you are proposing to restrict the discharge rate of surface water run-off to greenfield rate. This is compliant with the preferred standard of London Plan Policy 5.13.

Despite the positives, it is slightly disappointing that the surface water drainage strategy is so heavily reliant on below ground tanks for attenuation. This attenuation could alternatively be provided by the inclusion of additional Sustainable Drainage System (SuDS) methods in compliance with the hierarchy within London Plan Policy 5.13. These would provide ecological benefits and be easier to maintain when compared to the proposed tanks.

We note that you have made reference to SuDS, and the hierarchy mentioned above, in paragraphs 6.2-6.14 of the FRA.However, we request you carry out more detailed feasibility assessments as to whether more SuDS could be included on the site. If the conclusion of the assessment is that no alternative methods are feasible then evidence and justification as to why attenuation cannot be provided through SuDS should be included within your FRA.

Where possible, green roofs should be included as outlined in policy 5.11 of the London Plan and the Sustainable Design and Construction SPG. Your FRA proposes a significant amount of green roofs which is very positive but it is not clear why more green roofs cannot be provided. If green roofs are not feasible detailed specific justification should be provided for each block/section of the proposed development.

If you amend the drainage scheme to include more SuDS and green roofs **or** further detailed justification is provided as to why they are not feasible we will be satisfied and have no concerns when consulted on this planning application.

I hope that these comments are helpful. We look forward to reviewing the

amended FRA.

Please contact me if you have any queries.

Yours sincerely

Ben Llewellyn
Planning Advisor
Direct dial 0203 263 8056
Direct e-mail northlondonplanning@environment-agency.gov.uk

Authorised by Candice Albon-Acting Team Leader, Sustainable Places Team

Appendix: D EA FLOOD MAP

Environment Agency

Enter a postcode or place name: Other topics for this area...

Barnet, Barnet Go Risk of Flooding from Rivers and Sea

Risk of Flooding from Rivers and S

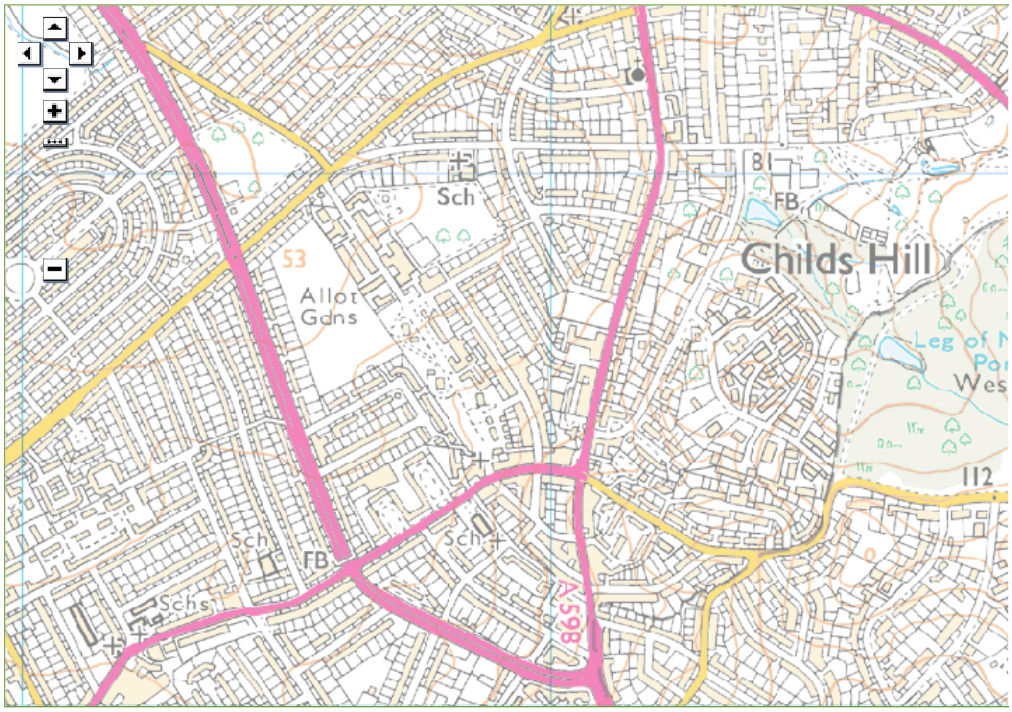
Map legend

Click on the map to see what is the Risk of Flooding at a particular location.

Flood Maps

- Flooding from rivers or sea without defences
- Extent of extreme flood
- Flood defences (Not all may be shown*)
- Areas benefiting from flood defences (Not all may be shown*)
- Main rivers

X: 524,964;Y: 186,656 at scale 1:10,000 Data search Text only versi



More about flooding:

Information Warning: Newport, South Wales

We are aware of problems with the flood map for the Newport area.
Please contact your local Natural Resources Wales office for accurate information.
We are currently working to correct this information.
Natural Resources Wales Website

Understanding the flood map

A more detailed explanation to help you understand the flood map shown above.

Current flood warnings

We provide flood warnings online 24 hours a day. Find out the current flood warning status in your local area.

Flood map - your questions answered

Answers to commonly asked questions about the flood map.

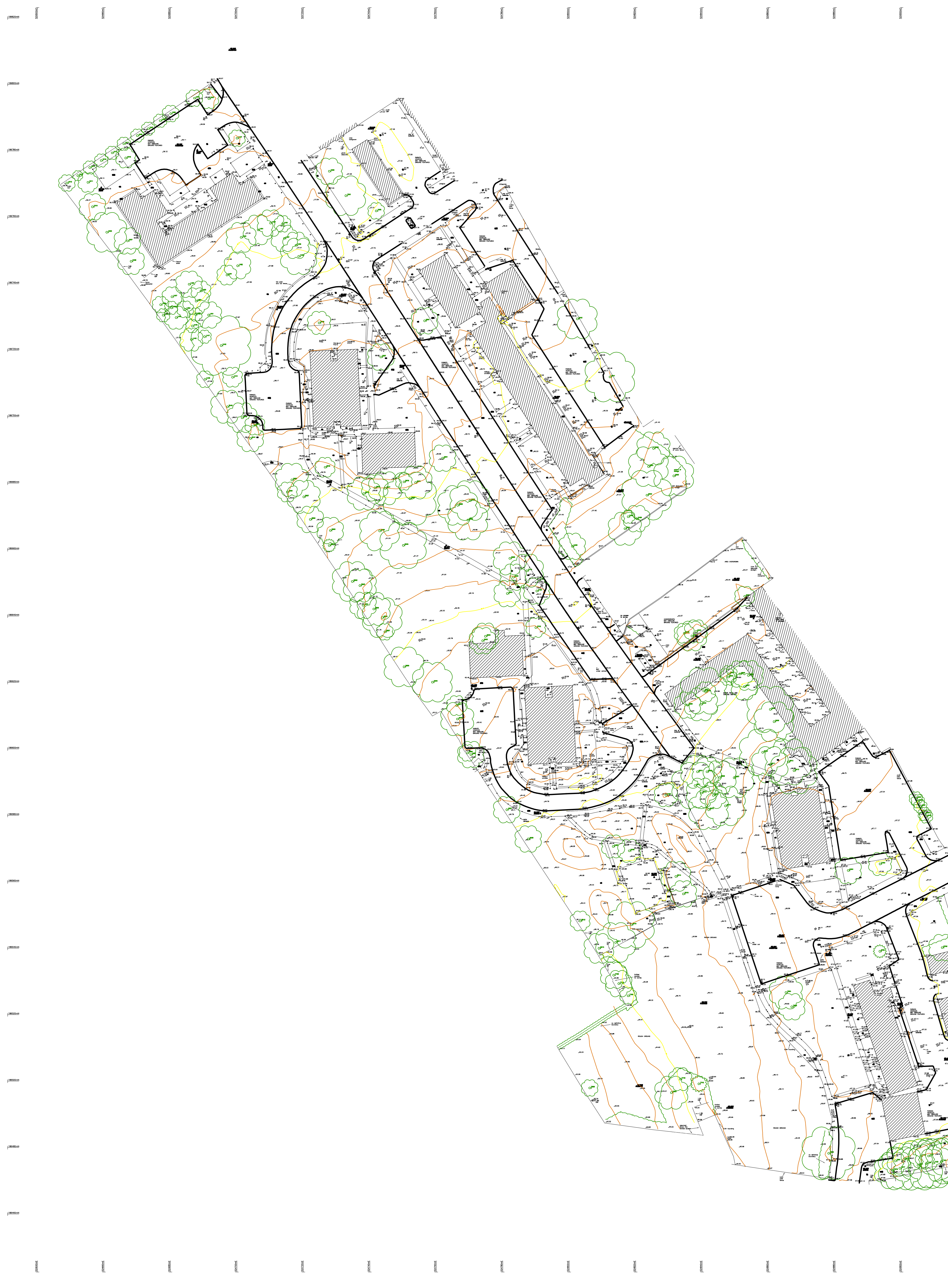
* **Legend Information:** Flood defences and the areas benefiting from them are gradually being added through updates. Please contact your local environment agency office for further details.

Appendix: E SFRA MAPS

Please see: http://www.nlwp.net/documents/sfra_maps.html

PDF too large to be included in Document.

Appendix: F TOPOGRAPHICAL SURVEY



NOTES

All dimensions are to be checked on site by the contractor before any work is commenced.
In the case of apparent discrepancy refer immediately to surveyors.
The accuracy and completeness of this survey is dependent on the original survey brief including the scale intended.
The type and extent of information and the survey accuracy will have been matched to the client's original requirements.
Twickenham Surveys accepts no responsibility or liability to later users without prior consent.
The detail of this survey was established for a brief requiring a 1:200 plot. It is therefore suitable for plotting or planning/designing at scales of 1:200 or smaller.
Level positions are indicated by a cross.
This survey did not include locating underground services and equipment.
Tree girths are representative only and reference should be made to the tree schedule if included in the survey brief.
Levels are taken on b/s kerb unless otherwise indicated.

SURVEY CONTROL NOTES

The horizontal control of this survey is based on Ordnance Survey national grid translated from GPS coordinates using the OSGB36(02) transformation supplied by Ordnance Survey. We have applied a reverse scale factor to maintain true ground distances based on STN102.
The vertical control of this survey is based on Ordnance Survey Datum translated from GPS levels using the OSGB36(02) transformation as supplied by Ordnance Survey. These levels may differ from existing Ordnance Survey Benchmarks in the area as these can no longer be relied upon to accurately define ODN as Ordnance Survey have not maintained them for 30 years.

LEGEND

N

TOPOGRAPHICAL SURVEY

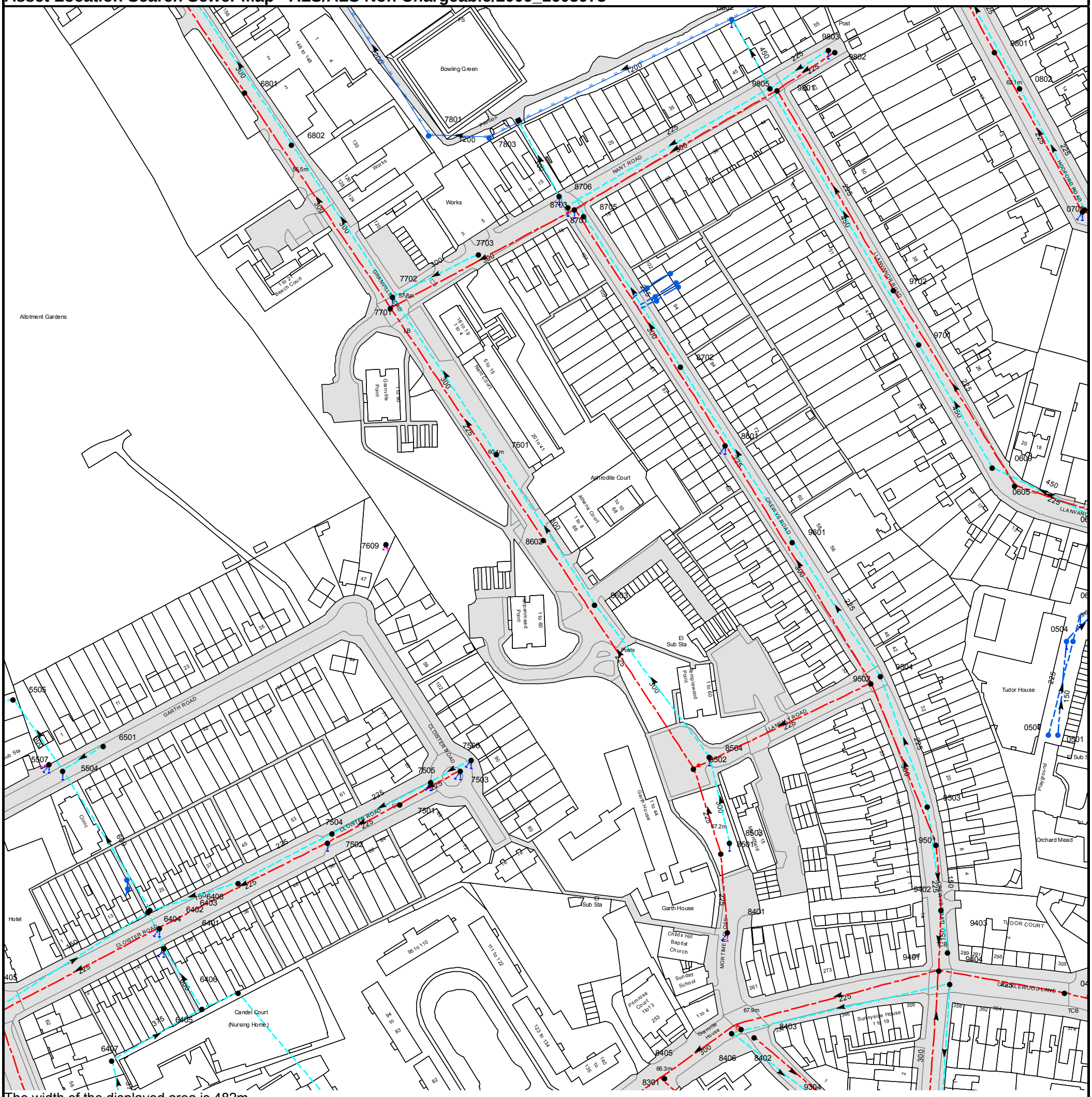
GRANVILLE ROAD
CRICKLEWOOD
LONDON NW2

Drawing No.	:	10115M
Scale	:	refer grid
Date	:	October 2010
Drawn by	:	ACF/JD
Checked by	:	JD/WH

TWICKENHAM SURVEYS
LAND AND BUILDING SURVEYORS
CENTRAL HOUSE
124 HIGH STREET
HAMPTON HILL
MIDDLESEX TW12 1NS
T-020 8614 4480 F-020 8977 6579
mail@twickenhamsurveys.co.uk
www.twickenhamsurveys.co.uk

Appendix: G THAMES WATER SEWER MAP

Asset Location Search Sewer Map - ALS/ALS Non Chargeable/2009_1603973



The width of the displayed area is 482m

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Appendix: H EXISTING IMPERMEABLE AREAS

KEY

CURRENT HARDSTANDINGS 1.232HA

CURRENT ROOF AREAS 0.428HA

TOTAL SITE AREA 3.680HA

REMAINING GREENFIELD AREA 2.020HA

CUTLINE

CUTLINE

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS:

FOR INFORMATION

EAS

Unit 108, The Maltings, Stanstead Abbotts, Hertfordshire, SG12 8HG
Tel: 01920 871777

www.eastp.co.uk

CLIENT:

GRANVILLE ROAD LLP

ARCHITECT:

PROJECT:

GRANVILLE ROAD
BARNET

TITLE:

EXISTING IMPERMEABLE AREAS

SCALE @ A1:	DESIGN-DRAWN:	DATE:
1:500	SA	09/10/2013

PROJECT No:	DRAWING No:
237	FRA SK01

Appendix: I

GREENFIELD RUNOFF CALCULATIONS

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	2.000	Urban	0.000
SAAR (mm)	700	Region Number	Region 6

Results l/s

QBAR Rural	8.8
QBAR Urban	8.8
Q100 years	28.0
Q1 year	7.5
Q30 years	19.9
Q100 years	28.0

Appendix: J EA SURFACE WATER FLOOD MAP

Risk of Flooding from Surface Water

Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.

The shading on the map shows the risk of flooding from surface water in this particular area.

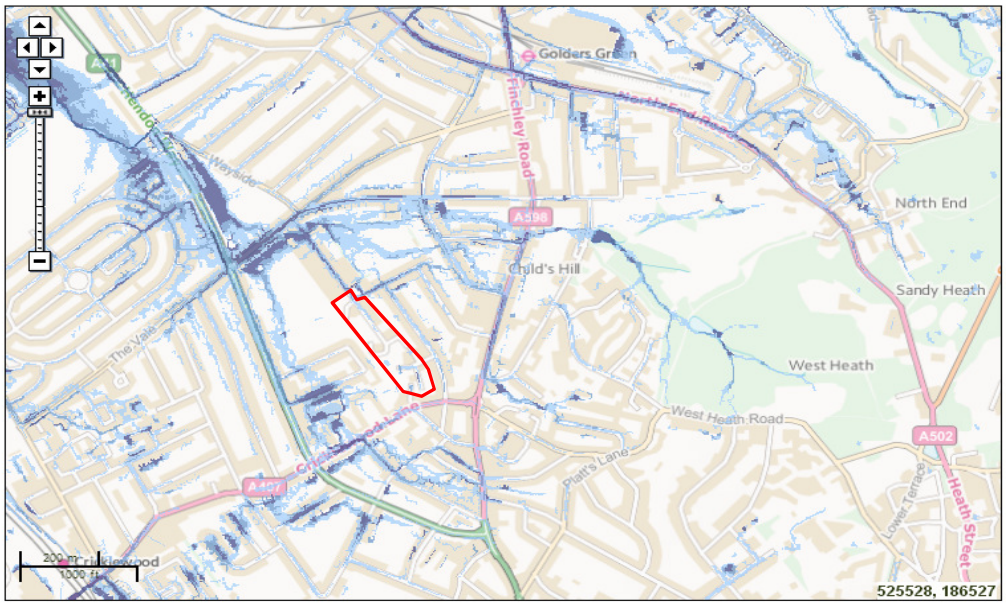
Click on the map for a more detailed explanation.

Map legend

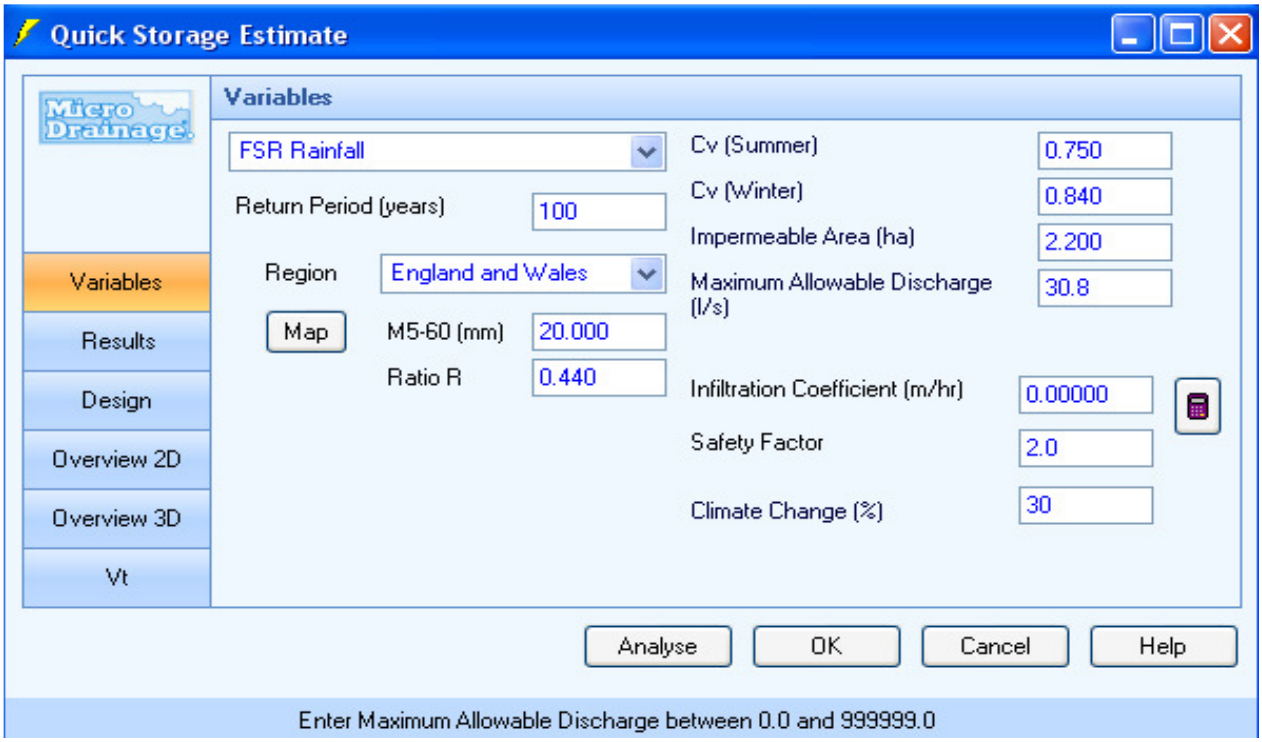
- Risk of Flooding from Surface Water
- High
- Medium
- Low
- Very Low

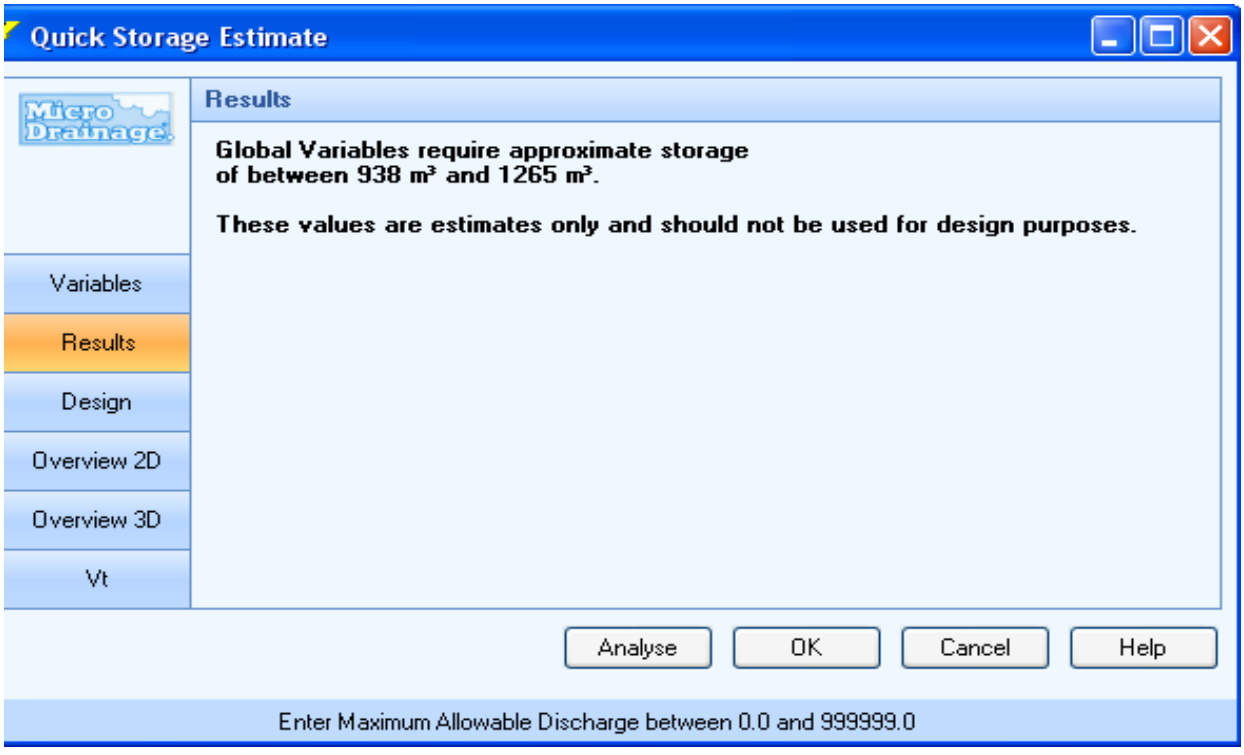
Map of NW2 2AT at scale 1:10,000

Data search



Appendix: K ATTENUATION CALCULATIONS


Quick Storage Estimate
Variables
FSR Rainfall
Return Period (years)
100
Region
England and Wales
Map
M5-60 (mm)
20.000
Ratio R
0.440
Cv (Summer)
0.750
Cv (Winter)
0.840
Impermeable Area (ha)
2.200
Maximum Allowable Discharge (l/s)
30.8
Infiltration Coefficient (m/hr)
0.00000
Safety Factor
2.0
Climate Change (%)
30
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Analyse
OK
Cancel
Help
Enter Maximum Allowable Discharge between 0.0 and 999999.0


Quick Storage Estimate
Results
Global Variables require approximate storage
of between 938 m³ and 1265 m³.
These values are estimates only and should not be used for design purposes.
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Analyse
OK
Cancel
Help
Enter Maximum Allowable Discharge between 0.0 and 999999.0

Appendix: L SuDS Strategy

SUDs

- Permeable bituminous aggregate parking bays
- Intensive Wildlfower Green roof
- Extensive sedum Green roof
- Soft landscape areas
- Planted Swale
- Porous self binding gravel
- Indicative areas for localised attenuation
- Possible location for attenuation tanks if required
- Rear Garden Water Butt

0 5m 10m 15m 20m

Granville Road

new granville

London Borough of Barnet

standard notes

1. Do not scale this drawing.
2. All dimensions must be checked on site and any discrepancies verified with the architect.
3. Unless shown otherwise, all dimensions are to structural surfaces.

THIS IS NOT A CONSTRUCTION DRAWING, IT IS UNSUITABLE FOR THE PURPOSE OF CONSTRUCTION AND MUST ON NO ACCOUNT BE USED AS SUCH.

drawing notes

revisions

13.06.14 P1 First Issue
23.06.14 P2 issue to Client
P3 26.06.14 Planning Issue
P4 28.07.14 Reissue follwing EA comments
P5 04.08.14 Issue following planning consultant comments
P6 14.08.14 Final Planning Issue

date 13/09/14

client New Granville LLP

scale 1 : 500

drawing SUDs Strategy

drawn BT **checked** GT **drawing number** 2928A - D_926 **rev** P6

C:\Users\amy.strong\Documents\2928A_GRANVILLE_Proposed_Landscape_CENTRAL_2013_amystrong.rvt

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e: post@levittbernstein.co.uk

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