Project Name:	Hampstead				K4 SOILS
Client:	Soils Ltd	Project no: J12146			
		Our job no: 10391			
Borehole No:	Sample No:	Depth m	Description	pH	Sulphate content (g/l)
BH1	13	6.00	Stiff fissured dark grey brown CLAY with scattered traces of selenite	7.0	1.21
BH2	19	9.00	Stiff fissured dark grey brown CLAY with traces of brown staining and scattered traces of selenite	7.2	1.32

Date	Summary of Test Results	Checked and Approved
14/01/2011	BS 1377 : Part 3 :Clause 5 : 1990 Determination of sulphate content of soil and ground water : gravimetric method	Initials : kp

Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

14 Netherhall Gardens,
London, NW3 5TQ

Surface Flow and Flooding Assessment

This report forms part of a wider Basement Impact Assessment

0041/LH/02-2012/0038

February 2012

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London, NW3 5TQ

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Client: Geotechnical and Environmental Associates

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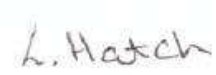

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Laura Hatch BSc (Hons) MSc AIEMA

Registration of amendments:

Report Revision	Date	Amendment Details	Revision Prepared By

Contents

1. Introduction

1.1. Introduction

Potamos Consulting have been instructed by Geotechnical and Environmental Associates on behalf of Netherhall Developments Ltd to carry out a Surface Flow and Flooding Assessment for development at Otto Schiff House, 14 Netherhall Gardens, London, NW3 5TQ.

The site currently comprises a three-storey early 1900s building at the junction between Netherhall Gardens and Nutley Terrace. This is linked to a further three-storey building dating from the 1950s via a corridor at each floor level. It is understood that it is proposed to refurbish the upper floors of the original 1900s building and demolish the 1950's building. A new basement is to be constructed under the entire footprint of the retained building and under the majority of the site at the rear. Additionally a new separate four-storey building is to be constructed at the rear of the site on top of the new basement structure. The rear section of the proposed basement will contain plant, storage, car parking and a vehicular ramp. The front section of the basement will be used as residential accommodation with new lightwells installed at various locations.

The London Borough of Camden has recently developed its Local Development Framework (LDF). The LDF now includes several new policies which are relevant to the proposed development (namely DP23: Water and DP27: Basements and Ligtwells). To meet the requirements of DP23 of the LDF a Surface Flow and Flooding Assessment is required to support the planning application and ensure that consideration is given to the amount and rate of runoff that may be generated by the development along with appropriate sustainable means of managing this so as to not increase the pressure on the combined sewer network and the risk of flooding.

In addition to DP23 and DP27, this assessment has also been carried out in accordance with additional planning guidance for the development of basements and lightwells (CPG 4) recently prepared by the London Borough of Camden to support the LDF. This report, in conjunction with the accompanying Hydrogeological Risk Assessment and Ground Investigation reports, forms part of a wider Basement Impact Assessment as required by CPG 4 and includes reference to all four stages of assessment namely Screening, Scoping, Site Investigation and study and Impact Assessment

In line with the requirements of CPG 4 this report has been peer reviewed by a chartered engineer with the Institution of Civil Engineers and found to be suitable. A letter confirming this review is included as Appendix A.

This report is confidential to Geotechnical and Environmental Associates, and Potamos Consulting accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely on the report at their own risk.

1.2. Scope of Works

The Drainage, Flooding and Groundwater Assessment has been carried out in accordance with CPG4 and therefore follows the recommended stages overleaf (Table 1):

Table 1 - Basement Impact Assessment process

Stage	Description	Purpose
Stage 1	Screening	Identification of any matters of concern which should be investigated (in line with CPG 4 screening flow charts)
Stage 2	Scoping	Identification of the potential impacts of the proposed scheme which have been shown in Stage 1 to need further investigation
Stage 3	Site Investigation and Study	Site investigation (including desk studies, investigations, monitoring and reporting) to develop further understanding of the site)
Stage 4	Impact Assessment	Evaluation of the direct and indirect implications of the proposed scheme on the receptors identified during Stage 1
Stage 5	Review and Decision Making	This stage is carried out by the London Borough of Camden and comprises an audit of the information supplied and a decision on the acceptability of the impacts of the basement proposal

Stage 1 of the assessment comprises an initial screening exercise in line with the requirements of CPG4 and the "Surface flow and flooding screening flowchart" which forms part of that document.

This is followed by a scoping assessment which comprises a desk study review of existing information about the site and includes:

- Collation and review of Environment Agency flood risk data for the site and surrounding area;
- Review of geological, hydrogeological and hydrological mapping/data to inform understanding of the site setting; and
- Calculation of the current and future runoff rates and volumes of surface water runoff from the site.

A site investigation was not considered to be required on this occasion on the basis that the primary concern relating to the development was surface water runoff as opposed to water resources beneath the ground e.g. groundwater. Some historical data from a previous investigation undertaken by VKHP Consulting is also available.

Finally the direct and indirect implications of the development on surface water flow and flooding are considered through an impact assessment with appropriate mitigation and management measures (such as sustainable drainage options) discussed.

The report has been prepared using published information and information provided by the client, which was made available at the time of writing only.

When preparing this assessment consideration has been given to the requirements of and methodologies recommended within the following documents:

- Planning Policy Statement 25: Development and Flood Risk;
- Development and Flood Risk: A Practice Guide Companion to PPS 25 "Living Draft";
- Environment Agency (EA) Flood Risk Assessment Guidance Note 3;
- London Borough of Camden development policy DP23: Water;
- London Borough of Camden development policy DP27: Basements and lightwells;

- Camden Planning Guidance CPG4: Basements and lightwells; and
- Camden Geological, Hydrogeological and Hydrological Study: Guidance for subterranean development.

2. Screening

Screening is the first stage of the Basement Impact Assessment (BIA) required by Camden Planning Guidance for development of basements and lightwells (CPG 4). Screening enables identification of any matters of concern to the development which should be further investigated and is a process of determining whether or not a full BIA is required.

The screening assessment has been undertaken in accordance with the “surface flow and flooding screening flowchart” which form Figure 3 of CPG 4. The screening flowchart requires consideration of a number of questions and an answer of “yes”, “no” or “unknown” to each.

The results of the screening exercise are provided in Table 2 below. Each stage of the proposed development scheme has been taken into account when answering each question.

Table 2: Surface flow and flooding screening chart

No.	Question	Answer	Description / Justification
1	Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is located approximately 1.2km southwest of Hampstead Heath and is outside of the River Fleet catchment which includes the ponds on Hampstead Heath.
2	As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak-runoff) be materially changed from the existing route?	No	The proposed development will result in a 489m^2 increase in hard surfaced / paved areas on site compared to the existing situation. However, it is proposed to manage runoff from the site so that post-development runoff rates and volumes are lower than present. Runoff routes will however remain largely unchanged.
3	Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	The proposed development will result in a 489m^2 increase in hard surfaced / paved areas on site compared to the existing situation.
4	Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	No	The basement will not significantly change the infiltration capacity of the soils at the site and hence the runoff profile. Runoff will be captured and discharged to the sewer as per the existing situation with excess water being stored in underground crates and therefore the development will not impact adjacent properties or downstream watercourses.
5	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	All surface water will be managed on site and discharges off-site will be of no different quality to existing. Additionally off-site discharge will be via the sewer and so there will be no impact on adjacent properties or off-site watercourses.
6	Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the basement is below the static water level of a nearby surface water feature?	No	The site does not fall within the South Hampstead, West Hampstead, Gospel Oak or King's Cross areas of Camden and is not located on one of the streets listed in CPG 4 as being at risk of surface water flooding.

Based on the findings of the screening and scoping process, as summarised in Table 2, the majority of concerns are not considered to be relevant to the proposed development. However the development proposals will result in a change to surface cover so there is a requirement to continue the Basement Impact Assessment.

The Basement Impact Assessment will focus on assessment of the likely change in impermeable surface area on site as a result of the development and hence the likely impact of the development on surface water runoff and how this will be managed to ensure the development has no detrimental impact on neighbouring properties or the downstream catchment.

3. Scoping

The screening process discussed in Chapter 2 identified that the likely change in the proportion of hard surfaces on the site, would need further investigation. The investigation undertaken to determine the potential impacts of the development is set out in this scoping section of the report.

3.1. Site Location

The site is located on Netherhall Gardens at its junction with Nutley Terrace within the Belsize Ward of the London Borough of Camden in northwest London. It is approximately centred on OS grid reference 526375E 184890N and covers an area of 1904m^2. The site location is shown on Drawing Number 0041/001 in Appendix B.

The site is set within a predominantly residential area bounded by Nutley Terrace to the north, the rear gardens of properties on Maresfield Gardens to the east, a school to the south and Netherhall Gardens to the west. Finchley Road underground railway station on the Piccadilly Line is a short distance southwest of the site.

3.2. Site Description

The site currently comprises a three-storey early 1900s building at the junction between Netherhall Gardens and Nutley Terrace. This is linked to a further three-storey building dating from the 1950s via a corridor at each floor level.

A topographical survey of the site was undertaken by Michael Gallie & Partners in August 2011. The levels on the survey are relevant to Ordnance Survey datum using the GPS static baseline method. The survey indicates the site to slope slightly downhill in a southerly direction away from Nutley Terrace from 72.06mAOD to a minimum of 69.49mAOD in the southwest corner. Within the existing original 1900s building ground floor levels are currently approximately 72.50mAOD.

3.3. Flood risk from rivers

The clay/sand junction of the Bagshot Formation and the Claygate Member and between the Claygate Member and the London Clay in the north of the Borough is the source of springs which radiate out to feed the various drainage channels on Hampstead Heath and in the surrounding area which comprise four main river systems: the Fleet, Tyburn and Westbourne Rivers which flow south eventually discharging into the River Thames, and a forth watercourse flowing north into the River Brent.

Hampstead Heath lies approximately 1.2km northeast of the site at its closest. Within the Heath there are more than 25 ponds forming chains of interlinked water features. The ponds were mainly constructed in the late 17th century to dam the rivers flowing across the Heath and their tributaries to provide a clean water supply to London. Today the rivers still flow through the dammed ponds although they are no longer used for water supply. Instead they are used for recreational activities, wildlife habitat and flood storage and are therefore protected under the Reservoirs Act.

Figure 11 of the Camden Geological, Hydrogeological and Hydrological Study indicates the proposed development site to be located in the headwaters of the River Westbourne. However, the study goes on to say that this watercourse is now predominantly culverted and incorporated within the storm drainage system which explains the watercourse not being shown on OS mapping of the site. The headwaters of the River Tyburn are also shown a short distance to the east of the site.

The Environment Agency's indicative online Flood Map (see Appendix C) shows the site to fall within Flood Zone 1. Flood Zone 1 is a Low Probability flood risk area where land is considered to have less

than a 1 in 1000 (0.1%) annual probability of flooding from rivers or the sea. Correspondence with the Environment Agency as part of this assessment has confirmed that the site is outside of any known main river floodplain and hence the site has less than a 0.1% annual probability of flooding (see Appendix C).

3.4. Flood risk from the sea

The proposed development site is located approximately 6km northwest of the nearest reach of the tidal River Thames. It is also approximately 65km inland of the North Sea and approximately 76km north of the English Channel. As such the site is not considered at risk of flooding from the sea.

3.5. Flood risk from groundwater

The proposed development site is shown on 1:50,000 scale British Geological Survey mapping and Figure 4 of the Camden Geological, Hydrogeological and Hydrological Study to be underlain by London Clay Formation. The Camden Geological, Hydrogeological and Hydrological Study advises that within the London Borough of Camden this ranges in thickness from 90 to 130m. There are no superficial deposits present. London Clay is generally a fine-grained grey firm to stiff clay, weathering to brown near the surface.

A previous site investigation undertaken by Soils Ltd to look at recurring subsidence damage and involving the excavation of six trial pits and the drilling of two deep boreholes was reported by VKHP Consulting in December 2010. The boreholes confirmed the subsoils at the site to comprise approximately 0.45 to 0.65m of Made Ground (dark brown sandy clay with occasional to abundant brick fragments) overlying London Clay (firm to stiff dark brown to grey occasionally fissured silty clay). The London Clay extended the full depth of the boreholes i.e. to at least 10m below ground level (bgl). No groundwater was encountered during the drilling of either borehole. The borehole records are provided as Appendix D.

Based on information provided within the Camden Geological, Hydrogeological and Hydrological Study it is understood that the London Clay has a relatively low permeability to groundwater. Despite this however, it should be noted that groundwater can permeate slowly through intact London Clay, sometimes flowing quickly along fissures and cracks in the clay and through localised areas of clay containing a higher proportion of silts and sand. The groundwater flow however, will always be significantly slower than in classified aquifers.

Taking into account the presence of London Clay at the surface of the proposed development, it is considered unlikely that an upper aquifer (e.g. perched groundwater in drift deposits overlying the London Clay) is present. The upper aquifer is typically the most relevant when assessing the potential impacts of a basement development due to the potential for encountering the aquifer during the excavation and following this the potential for the obstruction of shallow groundwater flow once the basement is complete.

The lower aquifer comprising the Chalk underlying the London Clay is deeply confined beneath the Clay. As such the proposed development is considered unlikely to impact on the lower aquifer.

Groundwater level data for the Barrow Hill borehole at OS GR 527653 183662, approximately 1.8km southeast of the site, as supplied by the Environment Agency, shows groundwater levels to have risen fairly steadily from approximately 53m bgl when the record began in 1981 to approximately 36m bgl in 2003, since which time levels have fluctuated between 36 and 40m bgl. Although some distance from the site, this, along with the lack of groundwater strikes in the previous site investigation, supports the likelihood that there is no upper aquifer present and the lower aquifer is at significant depth.

This is further supported by the groundwater vulnerability maps on the Environment Agency's website which indicate that the site is situated on unproductive strata (a rock of drift deposit with low permeability that has negligible significance for water supply or river base flow) outside of any groundwater source protection zones. This is also confirmed by the Groundwater Vulnerability map and the Bedrock Aquifer Designation map in the Envirocheck report obtained for the site by Geotechnical and Environmental Associates (Appendix E).

Additionally, the site is not situated within a groundwater source protection zone (see the Source Protection Zones map from the Envirocheck report, Appendix E).

Finally, as discussed above in terms of flood risk from rivers, the Camden Geological, Hydrogeological and Hydrological Study notes that at the sand/clay junctions between the Bagshot Formation and Claygate Member, and between the Claygate Member and the London Clay, springlines form at the ground surface and radiate out to feed the various drainage channels on Hampstead Heath. Hampstead Heath lies approximately 1.2km northeast of the site at its closest and the nearest springs marked on OS mapping are more than 1.6km distant.

3.6. Flood risk from surface water runoff

The proposed development site is not shown on Figure 15 of the Camden Geological, Hydrogeological and Hydrological Report as being on a road which experienced significant sewer flooding in the events of August 1975 or August 2002 nor is it in an area with the potential to be at risk of surface water flooding.

The nearest surface water feature to the site comprises a small pond within a public building complex approximately 685m southeast of the site at OS GR 526764E 184288N. The next nearest surface water feature is Hampstead No. 1 Pond, the most southerly pond of the Hampstead Ponds chain on Hampstead Heath, approximately 1.25km northeast of the site at OS GR 527232E 185826N.

The site has a total area of 1,904m^2 and currently comprises approximately 982m^2 of impermeable surfaces (the existing buildings and associated hard landscaping area) and approximately 922m^2 of permeable surfaces (green space). Current peak surface water runoff rates from the site in a variety of storm events have been estimated using the Modified Rational Method (Hydraulics Research Limited, 1981). A copy of the calculations is provided in Appendix F and the estimated runoff rates are summarised in Table 3 below. It can be seen that in the peak 1 in 100 year plus climate change five minute storm the peak runoff rate from the site is likely to be 69.71 l/s. The calculations take into account the negligible permeability of the London Clay deposits at the site as discussed in Section 3.5 above.

Table 3: Existing peak surface water runoff rates (l/s)

Return Period (Years)	Storm Duration (Minutes)	Rainfall Intensity (mm/hr)	Peak Runoff Rate (l/s)
1	5	71.92	22.97
	15	43.32	13.84
	30	22.17	7.08
	60	17.47	5.58
5	5	121.52	38.81
	15	71.97	22.99
	30	44.43	14.19
	60	28.12	8.98
30	5	172.22	55.01
	15	106.24	33.93
	30	65.99	21.08
	60	42.32	13.52
100	5	218.24	69.71
	15	137.70	43.98
	30	86.27	27.56
	60	55.42	17.70

Thames Water's sewer asset plans (Appendix G) indicate that it is likely that surface water runoff from the site currently discharges to a combined sewer in the highway of either Nutley Terrace or Netherhall Gardens. However, the drainage survey undertaken by Scantech Services and reported by VKHP Consulting in December 2010 as part of an investigation into recurrent subsidence at the site indicates that the site may drain to both via two separate combined outlets with the north and west draining to Nutley Terrace and the southern part of the site draining to Netherhall Gardens.

Thames Water's records (Appendix G) also confirm the findings of the Camden Geological, Hydrogeological and Hydrological Study that there have been no historic incidents of flooding at the site as a result of surcharging public sewers.

3.7. Flood risk from foul water

As discussed in relation to surface water runoff, the proposed development site is not shown on Figure 15 of the Camden Geological, Hydrogeological and Hydrological Report as being on a road which experienced significant sewer flooding in the events of August 1975 or August 2002. This is confirmed by Thames Water's records of historic sewer flooding incidents.

Thames Water's sewer asset plans (Appendix G) indicate that it is likely that foul water from the site currently discharges to a combined sewer in the highway of either Nutley Terrace or Netherhall Gardens or possibly both as discussed above.

3.8. Flood risk from reservoirs, canals and other artificial sources

Two of the ponds which form part of the Highgate Chain on Hampstead Heath, Highgate Men's Bathing Pond (36,000m^3) and Highgate Model Boating Pond (46,000m^3) are the largest and second largest on the Heath and given their size fall under the remit of the Reservoirs Act. Due to the volume of water which they hold the ponds are generally considered to pose a medium risk of flooding however they are distant from the site and the likelihood of failure is low. Runoff into the ponds is controlled and the pond structures are well-maintained. Additionally mapping on the Environment Agency's website showing the risk of flooding from reservoirs (Appendix C) indicates that any flooding

from the ponds which does occur would flow downslope away from the site in a south-easterly direction towards Gospel Oak and Tufnell Park.

The Regent's Canal, which winds through the London Borough of Camden from Regent's Park through Camden Town and King's Cross providing a link from the Paddington Arm of the Grand Union Canal to the Limehouse Basin and the River Thames in the east, is approximately 1.8km southeast of the proposed development site and is therefore unlikely to either be affected by the development or pose any risk of flooding to it. Additionally, canals are generally considered to pose a low risk of flooding as they have limited surface water inputs and inflows and water levels are generally controlled.

4. Proposed development

The site currently comprises a three-storey early 1900s building at the junction between Netherhall Gardens and Nutley Terrace. This is linked to a further three-storey building dating from the 1950s via a corridor at each floor level.

It is understood that it is proposed to refurbish the upper floors of the original 1900s building and demolish the 1950's building. A new basement is to be constructed under the entire footprint of the retained building and under the majority of the site at the rear. Additionally a new separate four-storey building is to be constructed at the rear of the site on top of the new basement structure. The rear section of the proposed basement will primarily contain plant, storage, car parking and a vehicular ramp. The front section of the basement will be used as residential accommodation including an entertainment/games area with new lightwells installed at various locations.

The proposed development will result in an increase in building footprint of 95m^2 and an increase in impermeable hardstanding areas of 394m^2 as shown on the two sketches provided in Appendix H. This results in an overall increase of 489m^2. Additionally post-development 146m^2 of the garden area will overly the basement structure, although given the low permeability of the existing clay soils at the site this is not anticipated to affect infiltration.

The development proposals are shown on Drawings 11011_P_LG_G200_001, 11011_00_G200_001, 11011_P_02_G200_001 and 11011_P_03_G200_001 in Appendix H.

5. Impact Assessment

For proposed basements in the Borough the Upper Aquifer is considered the most relevant as it comprises the water table that could be encountered when excavating the basement, and following this could be interrupted or obstructed by the presence of the structure once the basement is complete. The Lower Aquifer, although the larger of the two aquifer systems and utilised for public drinking water supplies, is unlikely to be impacted upon by basement developments due to its depth below the London Clay.

As discussed in Chapter 3, in the case of the proposed development site, with London Clay at the surface it is considered unlikely that an upper aquifer (e.g. perched groundwater in drift deposits overlying the London Clay) is present and therefore the proposed development is very unlikely to impact any aquifer. Groundwater vulnerability maps on the Environment Agency's website indicate that the site is situated on unproductive strata.

As discussed in Chapter 4, the re-development will result in an increase in the impermeable area on site of 489m^2. As such surface water runoff rates and volumes from the site post-development are also expected to increase.

The revised runoff estimates for the site post development are shown in Table 4 below and the calculations are included in Appendix F. When compared to the pre-development estimates provided in Table 3 it can be seen that in the peak 1 in 100 year five minute storm peak runoff from the site would increase by 34.71 l/s from 69.71 l/s to 104.42 l/s.

Table 4: Post-development peak surface water runoff rates (l/s)

Return Period (Years)	Storm Duration (Minutes)	Rainfall Intensity (mm/hr)	Peak Runoff Rate (l/s)
1	5	71.92	34.41
	15	43.32	20.73
	30	22.17	10.61
	60	17.47	8.36
5	5	121.52	58.14
	15	71.97	34.43
	30	44.43	21.26
	60	28.12	13.45
30	5	172.22	82.40
	15	106.24	50.83
	30	65.99	31.57
	60	42.32	20.25
100	5	218.24	104.42
	15	137.70	65.88
	30	86.27	41.28
	60	55.42	26.52

Policy DP23 of the London Borough of Camden LDF (overleaf) requires that developments reduce their water consumption and pressure on the combined sewer network and the risk of flooding through the capture and re-use of surface water and grey water on-site. Whilst Policy DP22 (overleaf) requires developments to include appropriate climate change adaptation measures including the management of surface water runoff through the installation of sustainable drainage systems.

Policy DP22 - Promoting sustainable design and construction

The Council will require development to incorporate sustainable design and construction measures. Schemes must:

a) demonstrate how sustainable development principles, including the relevant measures set out in paragraph 22.5 below, have been incorporated into the design and proposed implementation; and
b) incorporate green or brown roofs and green walls wherever suitable.

The Council will promote and measure sustainable design and construction by:

c) expecting new build housing to meet Code for Sustainable Homes Level 3 by 2010 and Code Level 4 by 2013 and encouraging Code Level 6 (zero carbon) by 2016.
d) expecting developments (except new build) of 500 sq m of residential floorspace or above or 5 or more dwellings to achieve "very good" in EcoHomes assessments prior to 2013 and encouraging "excellent" from 2013;
e) expecting non-domestic developments of 500sqm of floorspace or above to achieve "very good" in BREEAM assessments and "excellent" from 2016 and encouraging zero carbon from 2019.

The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures, such as:

f) summer shading and planting;
g) limiting run-off;
h) reducing water consumption;
i) reducing air pollution; and
j) not locating vulnerable uses in basements in flood-prone areas.

Policy DP23 - Water

The Council will require developments to reduce their water consumption, the pressure on the combined sewer network and the risk of flooding by:

a) incorporating water efficient features and equipment and capturing, retaining and re-using surface water and grey water on-site;
b) limiting the amount and rate of run-off and waste water entering the combined storm water and sewer network through the methods outlined in part a) and other sustainable urban drainage methods to reduce the risk of flooding;
c) reducing the pressure placed on the combined storm water and sewer network from foul water and surface water run-off and ensuring developments in the areas identified by the North London Strategic Flood Risk Assessment and shown on Map 2 as being at risk of surface water flooding are designed to cope with the potential flooding;
d) ensuring that developments are assessed for upstream and downstream groundwater flood risks in areas where historic underground streams are known to have been present; and
e) encouraging the provision of attractive and efficient water features.

Additionally, CPG4 requires that basement developments have no impact on groundwater or the sensitive surface water features on Hampstead Heath and their associated risk of flooding and water quality.

To meet the requirements of Policies DP22 and DP23 and CPG4 and mitigate the potential impacts of the development, runoff will need to be reduced post-development compared to the existing situation. It is therefore proposed to reduce post-development runoff from the site to the Greenfield equivalent rate.

The Greenfield Runoff Rate for the site can be determined using the methodology set out in the Institute of Hydrology Report Number 124 (IoH 124) and guidance stipulated in the Interim Code of Practice for Sustainable Drainage Systems (National SuDS Working Group, 2004). These state that the Greenfield runoff rate for sites below 50ha can be derived from the calculated mean annual flood flow, QBAR. A copy of the calculations is provided in Appendix I and the estimated runoff rates are summarised in Table 5 below.

Table 5: Greenfield Runoff Rate

Event	Flow Rate (m^3/s)	Flow (l/s)	Flow Rate (l/s/ha)
QBAR	0.0008	0.85	4.451
1 year (Q1)	0.0007	0.72	3.783
5 year(Q5)	0.0011	1.08	5.697
25 year (Q25)	0.0018	1.81	9.525
30 year (Q30)	0.0019	1.89	9.970
100 year (Q100)	0.0027	2.70	14.200

The SuDS options available for reducing the runoff from the site to the Greenfield rate are limited by the characteristics of the site. It is not considered an option to use infiltration-based SuDS techniques such as soakaways due to the clay soils/geology at the site having poor permeability. Consequently the preferred surface water management option for the site is to attenuate rainwater in storage crates (aquacells) beneath the garden area for controlled discharge to Thames Water's sewers, via the existing connection. As discussed above, it would be our intention to reduce the runoff discharged to the Thames Water's sewer to the Greenfield equivalent rate; however the CIRIA SuDS Manual (CIRIA, 2007) states that it is essential to adjust the limiting discharge rate to take into account the need to have a minimum practical orifice size of 75mm diameter to ensure the risk of blockage is acceptable, although sewage undertakers usually insist on a minimum of orifice of 150mm diameter. The only exception to this rule is for outfalls downstream of filtration devices such as permeable pavements which through the nature of their operation will significantly reduce the risk of blockage. As such it is generally accepted that with a minimum orifice size of 75mm and a recommended gradient of 1:30 for a pipe of that size limitation of flow to less than 5l/s is impractical.

The MicroDrainage software (Version 12.6) has been used to estimate that storage of between 50 and $75m^3$ would be required to manage the runoff in all storms up to and including the 1 in 100 year plus 30% event so that off-site runoff to the local sewer is limited to the practical minimum rate of 5 l/s. The full output from MicroDrainage is provided in Appendix J. The expected infiltration rate across the site was set to 0.0001 as recommended by Table 4.7 of the SuDS Manual (CIRIA, 2007) for clay soils. Detailed design in terms of the location, depth and configuration of the crates will be required pre-construction however sufficient space would be available in garden areas to the west of the buildings adjacent to Netherhall Gardens to accommodate the required storage.

Figures 24 to 26 of the Camden Geological, Hydrogeological and Hydrological Study indicate that there was only one basement planning application in the vicinity of the site between June 2005 and February 2010. This was for a multiple dwelling on Maresfield Gardens to the immediate east of the proposed development site and was approved.

6. Conclusions

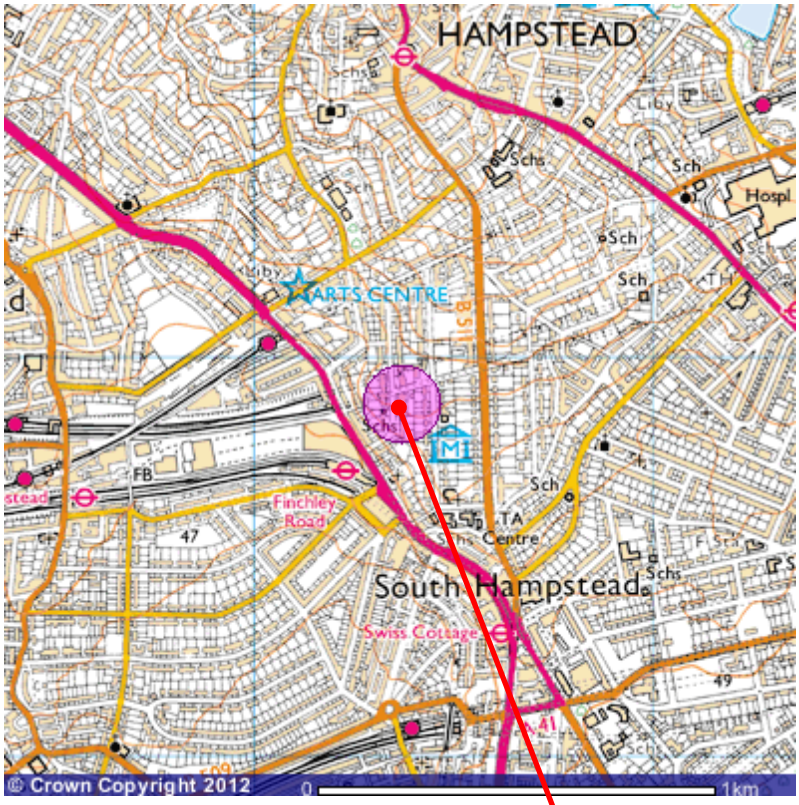
A screening exercise undertaken in line with the requirements of Camden Planning Guidance (CPG 4) identified that as the proposed development will result in a change in the impermeable surface areas on site a full Basement Impact Assessment would be required. This report forms part of that Basement Impact Assessment along with the accompanying Subterranean (Groundwater) Flow and Ground Investigation reports.

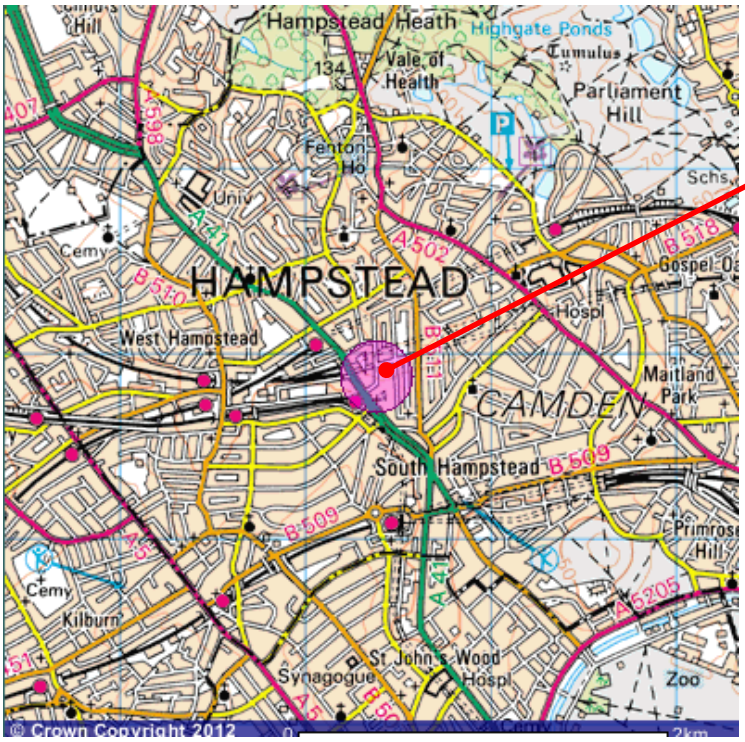
More information about the proposed development and the existing geological, hydrogeological and hydrological situation at the site was collected as part of the scoping stage of the assessment. At the conclusion of this stage of the assessment a site investigation was not considered to be required to provide additional information. Some information from a previous site investigation was however available.

The impact assessment identified that the proposed development will result in an overall 489m^2 increase in impermeable site area due to increases in both the built footprint and the associated hard landscaping at the site. Hence, if un-managed, the proposed development would result in an increase in peak runoff rates and volumes from the site. However, London Borough of Camden LDF policies DP22 and DP23 require that developments reduce the pressure on the local sewer network and manage the effects of climate change by reducing surface water runoff. As such it is proposed to meet the requirements of these policies and mitigate the impacts of the proposed development by incorporating a SuDS scheme, comprising underground aquacell surface water storage crates, into the development proposals so as to reduce the surface water runoff rates and volumes being released from the site to the local sewer in all events up to and including the 1 in 100 year plus 30% event, as close as possible to Greenfield equivalent rates. Runoff is proposed to be limited to 5 l/s which is the recommended minimum discharge to prevent pipe blockage. To achieve this aquacells, offering between 50 and 75m^3 of storage will be provided below the garden area to the west of the buildings with outflow controlled by an orifice. Detailed design will be required prior to construction.

Appendix A

Appendix B





The Site

North

POTAMOS CONSULTING

Site:
Otto Schiff House, 14 Netherhall Gardens, London, NW3 5TQ

Drawing Title:	Drawing No:	Project No:	Drawn By:	Date:	Scale:
Site Location Plan	0041/001	0041	LH	01/02/2012	NTS

Appendix C

Laura Hatch - Potamos Consulting

From: NET Enquiries <NETenquiries@environment-agency.gov.uk>
Sent: 10 February 2012 12:30
To: Laura Hatch - Potamos Consulting
Subject: NE29947MF - Flood Risk Information Request - Otto Schiff House, 14 Netherhall Gardens, London, NW3 5TQ
Attachments: Groundwater data.xls; Standard Notice.pdf

Dear Laura,

Thank you for your enquiry regarding Otto Schiff House, 14 Netherhall Gardens, NW3 5TQ.

The site in question is outside any known main river flood plain. This means that the chance of river flooding is less than 0.1% in any given year. I have no record of river flooding at this site.

We advise you to contact the local water company regarding previous or potential flooding from sewers. You may also wish to contact the local authority regarding flooding from any non-main rivers or surface water runoff

Unfortunately I can not provide a flood zone map for the above address as there are no flood zones in the area. There is also no relevant flood levels available for this site.

We do not hold records of likelihood of groundwater flooding, however I have attached our groundwater level Data for this area.

This site is not on a Aquifer or a Source Protection Zone.

I hope this has been of help, however if you have any queries please feel free to contact me directly.

Kind regards

Matt Frazer
External Relations Officer
North East Thames Area
Tel: 01707 632301
Email: NETenquiries@environment-agency.gov.uk

We would be really grateful if you could spare five minutes to help us improve our service. Please click on the link below and fill in our survey – we use every piece of feedback we receive.

https://web.questback.com/isa/qbv.dll/SQ?q=8w2Qkfx%2BivseokDpT0B63lh1YXluaKKXuf2xnWFtQPwSWg%3D%3D

From: Laura Hatch - Potamos Consulting [mailto:laura.hatch@potamosconsulting.co.uk]
Sent: 01 February 2012 18:15
To: NET Enquiries
Subject: Flood Risk Information Request - Otto Schiff House, 14 Netherhall Gardens, London, NW3 5TQ

Standard Notice

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Environment Agency

Enter a postcode or place name: NW3 5TQ Go

Other topics for this area... Risk of Flooding from Rivers and Sea

Risk of Flooding from Rivers and Sea

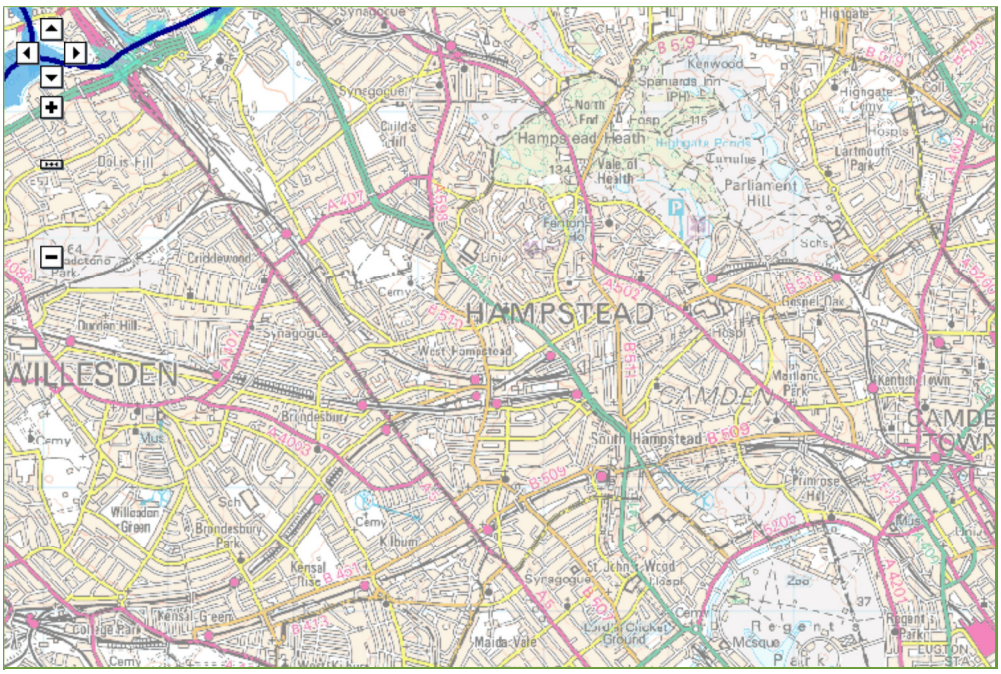
Map legend

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
  - Areas benefiting from flood defences
  - Main rivers

NW3 5TQ at scale 1:40,000

Text only version



Flood Map – Information Warnings

Manchester Ship Canal

Flood Mapping of the Manchester Ship Canal in Trafford, Salford and Warrington may be subject to revision as a result of representations. For further information please contact the Environment Agency on 03708 506 506.
Users of the Flood Zone Map should be aware that we have received a Judicial review challenge to the mapping of the Manchester Ship Canal at Trafford, Salford and Warrington on the ground that the preparation of the map is flawed In respect of our consideration of the role of the sluice gates in preventing flooding.
We are defending the challenge and believe and are advised that it is ill-founded. Nevertheless, pending determination of the challenge, users of the map need to consider whether the existence of the Challenge, and the basis of it, affects the weight they judge may be given to the zoning of the Manchester Ship Canal within the Flood Map.

More about flooding:

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.

creating a better place

Environment Agency

Enter a postcode or place name:

Go

Other topics for this area...

Risk of Flooding from Reservoirs

Risk of Flooding from Reservoirs

Map legend

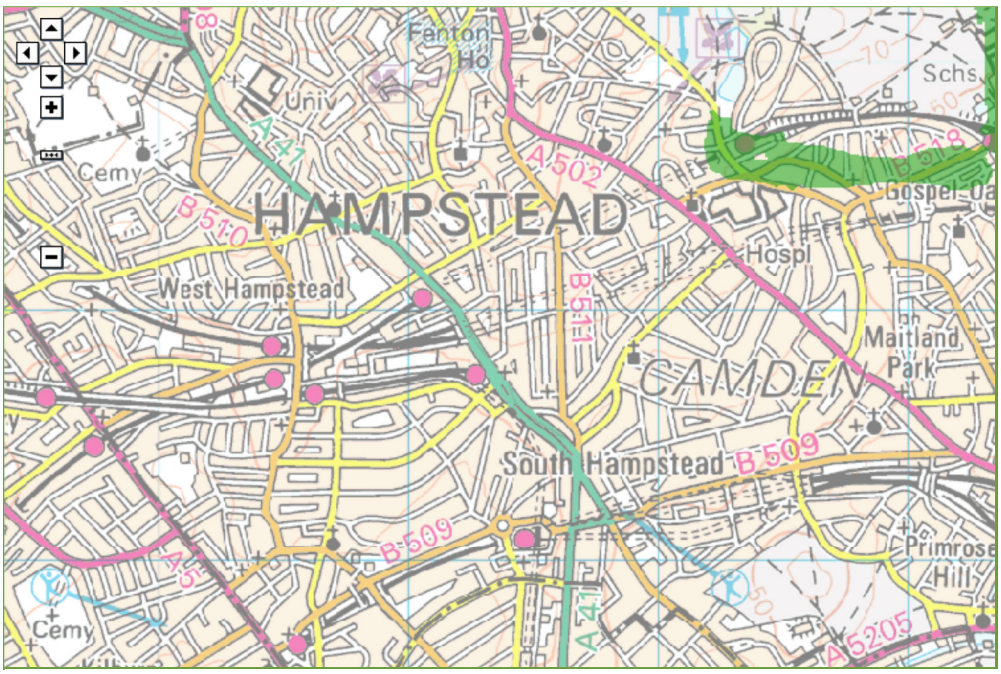
Click within the extent of flooding to see which reservoirs affect this area

Risk of Flooding from Reservoirs

Maximum extent of flooding

X: 526,373;Y: 184,887 at scale 1:20,000

Text only version



Find out more:

This map shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. Since this is a prediction of a worst case scenario, it's unlikely that any actual flood would be this large.

Remember - reservoir flooding is extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925. Since then reservoir safety legislation has been introduced to make sure reservoirs are well maintained.

Please note that only flood maps for large reservoirs are displayed. Flood maps are not displayed for smaller reservoirs or for reservoirs commissioned after reservoir mapping began in spring 2009. The reservoir flood maps also don't give any information about how likely any area is to be flooded.

If your property is within the green highlighted area, then you could be affected by reservoir flooding. To find out more about the reservoirs that could cause this flooding, click on the map within the green highlighted area. You will find the name and ownership details of the reservoirs that could cause flooding in your area.

If you want to find out about local emergency plans you should contact the local authority responsible for that emergency plan but be aware that these reservoir flood plans may take some time to develop. You can find out which local authority to contact by clicking on the map.

Reservoir flooding

Guidance for people living near reservoirs

Your questions answered

Who to contact

creating a better place

Appendix D

soils LIMITED

Soils Limited
Tel: 01737814221
Fax: 01737812557
email: ns@soilslimited.co.uk

Borehole No **BH 1**
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Otto Schiff House	12146		Cable
Location: Otto Schiff House, 14 Netherhall Gardens, NW3 5TQ		Level: -	Scale 1:50
Client: vkhp Consulting Ltd		Dates: 16/12/2010	Logged By SW

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.25	D		0.28			MADE GROUND Dark brown sandy clay with occasional brick fragments
		0.50	B		0.45			MADE GROUND Dark brown sandy clay in a matrix of brick rubble
		1.00	SPT	N=10				LONDON CLAY FORMATION Firm to stiff dark brown grey silty occasionally fissured CLAY with occasional partings of grey fine sand and scattered traces of selenite and occasional roots and rootlets
		1.00	D	N=10 (1,2,2,3,2,3)				
		2.00-2.45	U	26				
		2.50	D					
		3.00	SPT	N=10				
		3.00	D	N=10 (1,2,2,2,3,3)				
		3.50	D					
		4.00-4.45	U	40				
		4.50	D					
		5.00	SPT	N=13				
		5.00	D	N=13 (2,2,2,3,4,4)				
		5.50	D					
		6.00-6.45	U	40				
		6.50	D					
		7.00	SPT	N=19				
		7.00	D	N=19 (2,2,4,4,5,6)				
		7.50	D					
		8.00-8.45	U	80				
		8.50	D					
		9.00	SPT	N=21				
		9.00	D	N=21 (2,3,4,5,6,6)				
		9.50-9.95	U	72				
		Type		Results				End of Borehole at 10.00 m

Remarks: 1 Hour hand digging pit to 1.0m, 3/4 hour bagging spoil and taking to front of house.
Well installed to 10.0m. No groundwater encountered.

AGS

Soils Limited
Tel: 01737814221
Fax: 01737812557
email: ns@soilslimited.co.uk

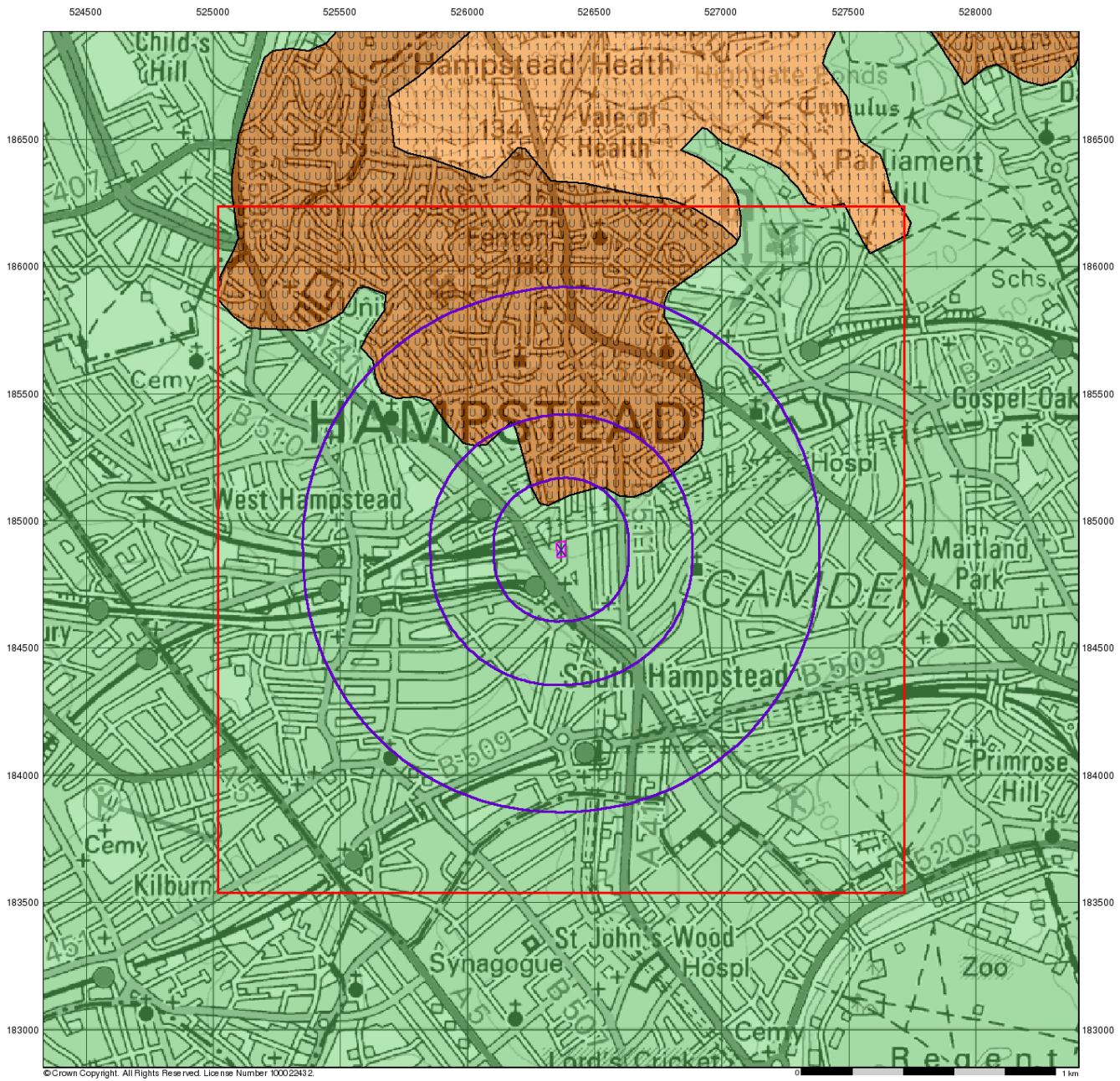
Project Name: Otto Schiff House	Project No.: 12146	Co-ords: -	Borehole No: **BH 2** Sheet 1 of 1
Location: Otto Schiff House, 14 Netherhall Gardens, NW3 5TQ		Level: -	Hole Type: Cable
			Scale: 1:50
Client: vkhp Consulting Ltd		Dates: 16/12/2010	Logged By: SW

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.25	D		0.30			MADE GROUND Dark brown sandy clay with occasional brick fragments
		0.50	B		0.65			MADE GROUND Dark brown sandy clay in a matrix of brick rubble
		1.00-1.45	U	28				LONDON CLAY FORMATION Firm to stiff dark brown grey silty occasionally fissured CLAY with occasional partings of grey fine sand and scattered traces of selenite and occasional roots and rootlets
		1.50	D					
		2.00	SPT	N=9				
		2.00	D	N=9 (1,2,2,2,2,3)				
		2.50	D					
		3.00-3.45	U	32				
		3.50	D					
		4.00	SPT	N=12				
		4.00	D	N=12 (2,2,2,3,3,4)				
		4.50	D					
		5.00-5.45	U	50				
		5.50	D					
		6.00	SPT	N=15				
		6.00	D	N=15 (2,2,3,3,4,5)				
		6.50	D					
		7.00-7.45	U	62				
		8.00	SPT	N=19				
		8.00	D	N=19 (2,3,4,4,5,6)				
		8.50	D					
		9.00-9.45	U	82				
		9.50	SPT	N=21				
		9.50	D	N=21 (2,4,4,5,6,6)				
			Type	Results				End of Borehole at 10.00 m

Remarks: 1 Hour hand digging pit to 1.0m. No groundwater encountered.

AGS

Appendix E



GEA Geotechnical & Environmental Associates

Groundwater Vulnerability

General

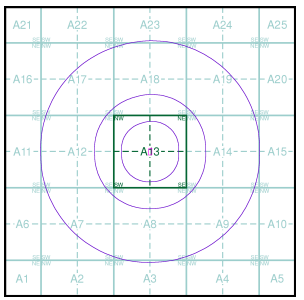
Specified Site | Specified Buffer(s) | Bearing Reference Point

Slice | Map ID

Agency and Hydrological

Geological Classes	Soil Classes
Major Aquifer (Highly Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Minor Aquifer (Variably Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Non Aquifer (Negligibly Permeable)	
Water or Sea	
Drift Deposit	

Site Sensitivity Context Map - Slice A



Order Details

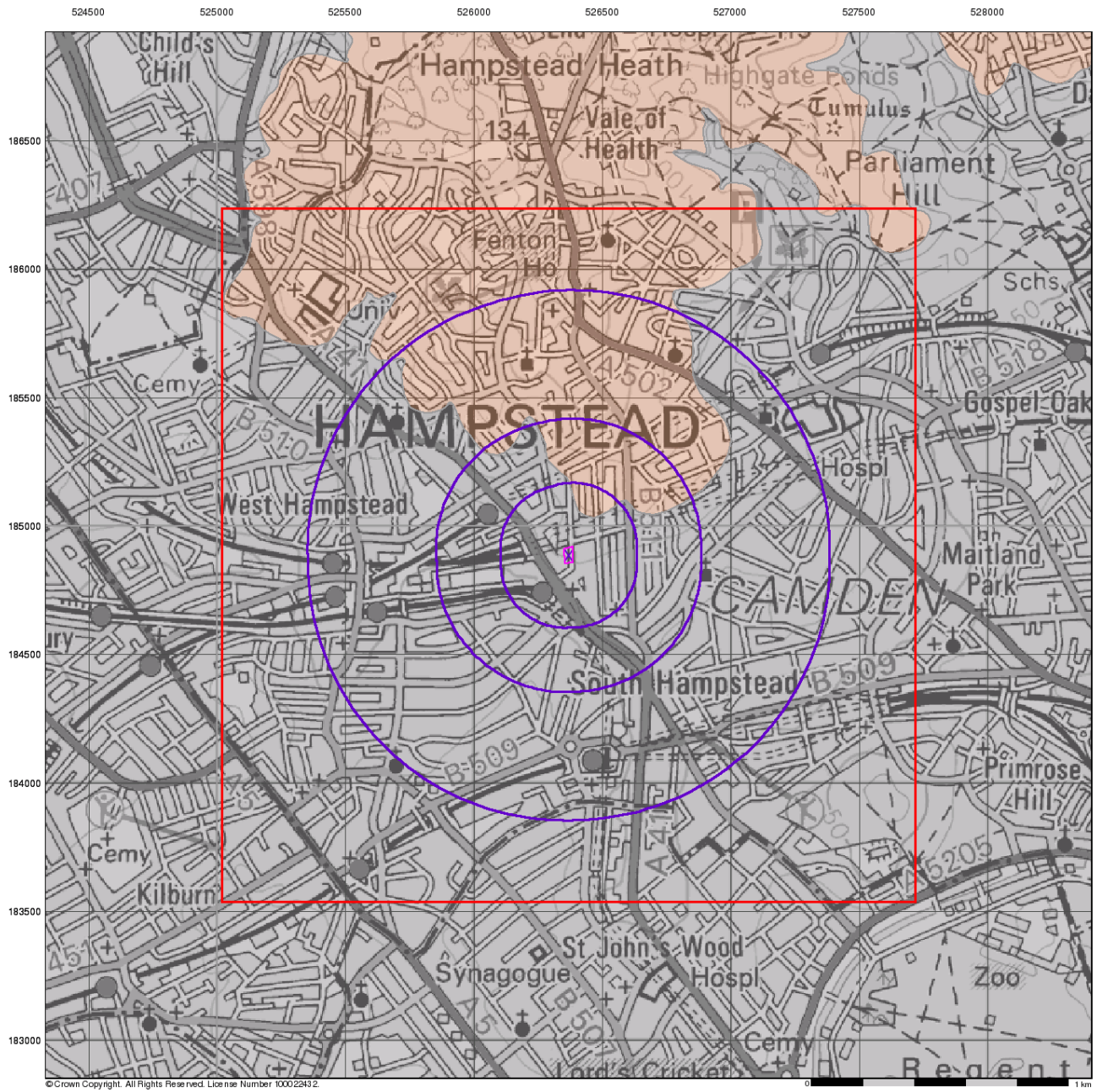
Order Number:	37369747_1_1
Customer Ref:	J12015
National Grid Reference:	526370, 184890
Slice:	A
Site Area (Ha):	0.19
Search Buffer (m):	1000

Site Details

14 Netherhall Gardens, LONDON, NW3 5TQ

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



GEA Geotechnical & Environmental Associates

Bedrock Aquifer Designation

General

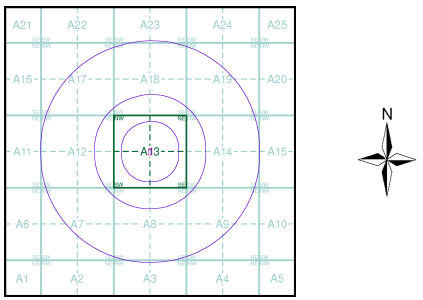
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

Site Sensitivity Context Map - Slice A

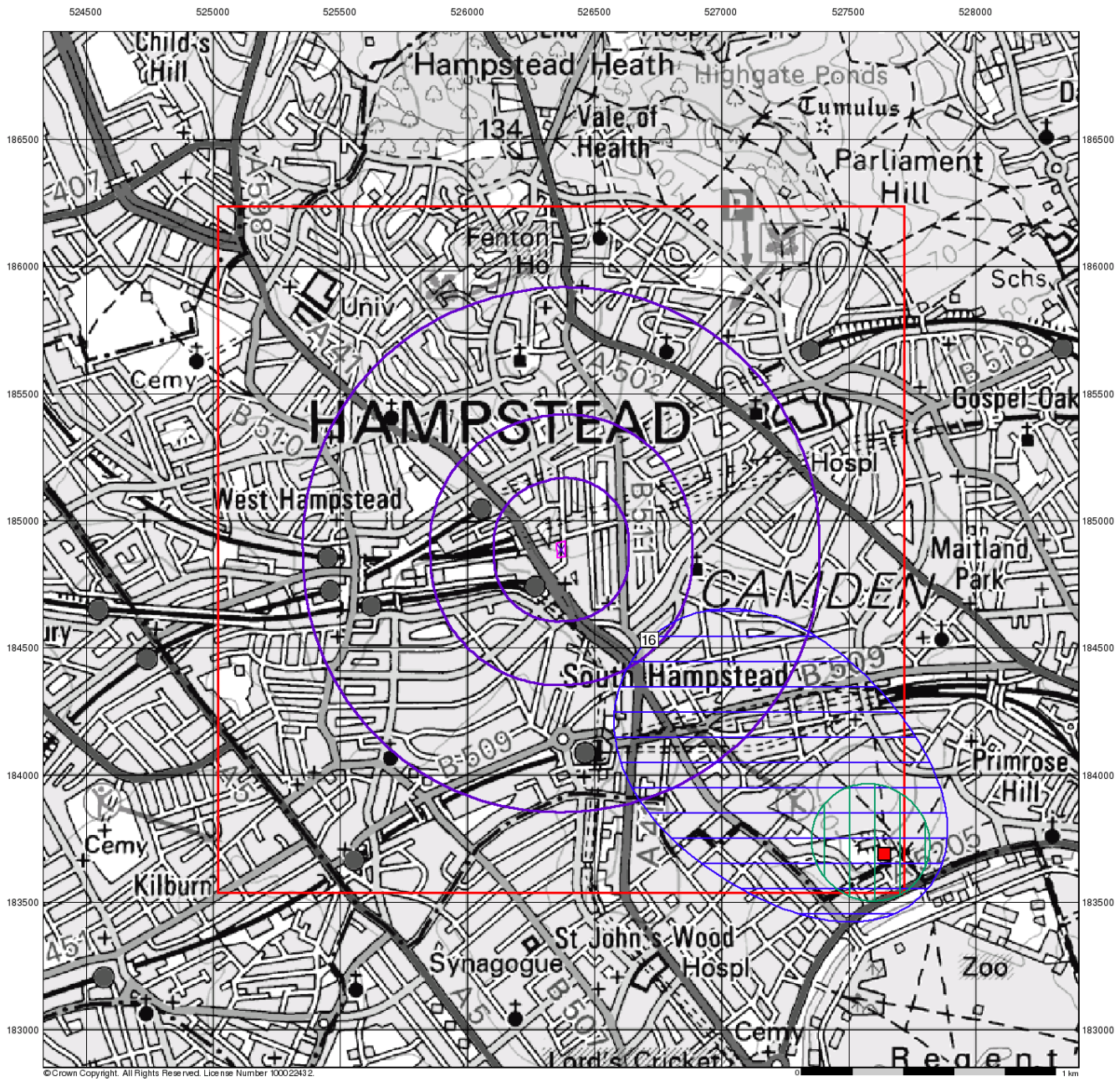


Order Details

Order Number:	37369747_1_1
Customer Ref:	J12015
National Grid Reference:	526370, 184890
Slice:	A
Site Area (Ha):	0.19
Search Buffer (m):	1000

Site Details

14 Netherhall Gardens, LONDON, NW3 5TQ



GEA Geotechnical & Environmental Associates

Source Protection Zones

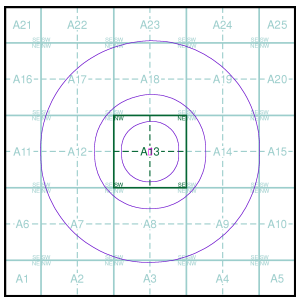
General

Specified Site | Specified Buffer(s) | Bearing Reference Point
Slice | Map ID

Agency and Hydrological

Source Protection Zone I
Source Protection Zone II
Source Protection Zone III
Zone of Special Interest
Source Protection Zone Borehole

Site Sensitivity Context Map - Slice A



Order Details

Order Number:	37369747_1_1
Customer Ref:	J12015
National Grid Reference:	526370, 184890
Slice:	A
Site Area (Ha):	0.19
Search Buffer (m):	1000

Site Details

14 Netherhall Gardens, LONDON, NW3 5TQ

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

Appendix F

POTAMOS CONSULTING				**Project No:** 0041		**Sheet:** 1 of 4		
				Project Title: 14 Netherhall Gardens, London, NW3 5TQ				
				Engineer: LH		**Date:** 10/02/2012		
Modified Rational (Wallingford) Method								
1) Determine the 5 year 60 minute rainfall depth (m5-60) for the site location from Figure A.1 of the Rational Method								
	m5-60 = 21mm							
Determine the ratio (r) of the 5 year 60 minute rainfall depth (m5-60) to the 5 year 2 day rainfall depth for the site location from Figure A.2 of the Rational Method								
	r = 0.4							
2) Determine the rainfall depths in the 5 year return period event for all required storm durations (m5-D) from m5-D = Z1 (m5-60). Z1 is obtained from Figures A3.a and A3.b of the Rational Method								
	m5-5	Z1 = 0.36		m5-5 = 21 x 0.36 = 7.56mm				
	m5-15	Z1 = 0.64		m5-15 = 21 x 0.64 = 13.44mm				
	m5-30	Z1 = 0.79		m5-30 = 21 x 0.79 = 16.59mm				
	m5-60	Z1 = 1.00		m5-60 = 21 x 1.00 = 21.00mm				
The calculation of peak runoff for storm durations up to 6 hours (m5-360) is desirable, however insufficient Z2 data (see below) is provided within the Rational Method to permit this and the use of FEH data is ill-advised for site specific assessments								
3) Convert the 5 year rainfall depths to rainfall depths for all required return period events (mT-D) from MT-D = Z2 (m5-D). Z2 is obtained from Tables A1 and A2 of the Rational Method								
	m1-5	Z2 = 0.61		m1-5 = 7.56 x 0.61 = 4.61mm				
	m1-15	Z2 = 0.62		m1-15 = 13.44 x 0.62 = 8.33mm				
	m1-30	Z2 = 0.63		m1-30 = 16.59 x 0.63 = 10.45mm				
	m1-60	Z2 = 0.64		m1-60 = 21.00 x 0.64 = 13.44mm				
	m5-5	Z2 = 1.03		m5-5 = 7.56 x 1.03 = 7.79mm				
	m5-15	Z2 = 1.03		m5-15 = 13.44 x 1.03 = 13.84mm				
	m5-30	Z2 = 1.03		m5-30 = 16.59 x 1.03 = 17.09mm				
	m5-60	Z2 = 1.03		m5-60 = 21.00 x 1.03 = 21.63mm				
	m30-5	Z2 = 1.46		m30-5 = 7.56 x 1.46 = 11.04mm				
	m30-15	Z2 = 1.52		m30-15 = 13.44 x 1.52 = 20.43mm				
	m30-30	Z2 = 1.53		m30-30 = 16.59 x 1.53 = 25.38mm				
	m30-60	Z2 = 1.55		m30-60 = 21.00 x 1.55 = 32.55mm				

POTAMOS CONSULTING	Project No: 0041	Sheet: 2 of 4
	Project Title: 14 Netherhall Gardens, London, NW3 5TQ	
	Engineer: LH	Date: 10/02/2012

m100-5	Z2 = 1.85	m100-5 = 7.56 x 1.85 = 13.99mm
m100-15	Z2 = 1.97	m100-15 = 13.44 x 1.97 = 26.48mm
m100-30	Z2 = 2.00	m100-30 = 16.59 x 2.00 = 33.18mm
m100-60	Z2 = 2.03	m100-60 = 21.00 x 2.03 = 42.63mm

4) Convert the rainfall depths into point intensities using the equation:

$$i = \frac{mT - D}{D}$$

where:

i = point intensity
T = return period
D = storm duration

m1-5 = 4.61/(5/60) = 55.32mm/hr
m1-15 = 8.33/(15/60) = 33.32mm/hr
m1-30 = 10.45/(30/60) = 20.90mm/hr
m1-60 = 13.44/(60/60) = 13.44mm/hr

m5-5 = 7.79/(5/60) = 93.48mm/hr
m5-15 = 13.84/(15/60) = 55.36mm/hr
m5-30 = 17.09/(30/60) = 34.18mm/hr
m5-60 = 21.63/(60/60) = 21.63mm/hr

m30-5 = 11.04/(5/60) = 132.48mm/hr
m30-15 = 20.43/(15/60) = 81.72mm/hr
m30-30 = 25.38/(30/60) = 50.76mm/hr
m30-60 = 32.55/(60/60) = 32.55mm/hr

m100-5 = 13.99/(5/60) = 167.88mm/hr
m100-15 = 26.48/(15/60) = 105.92mm/hr
m100-30 = 33.18/(30/60) = 66.36mm/hr
m100-60 = 42.63/(60/60) = 42.63mm/hr

5) Apply an aerial reduction factor (if required) to the rainfall using Figure A.4 of the Rational Method based on the site area of 2,800m^2 (0.0019km2/0.1904ha). Aerial reduction factors are only required for sites over 1km^2 in area and hence will not be applied to the rainfall intensities calculated above.

6) Adjust the peak rainfall intensities for the anticipated effects of climate change. This is done in line with the recommendations given in Appendix B of Planning Policy Statement 25 (PPS25) (Communities and Local Government 2006, updated 2010) which suggests an increase in peak rainfall intensity of 30% between 2085 and 2115, appropriate to the 100 year design lifetime of the development

POTAMOS CONSULTING				**Project No:** 0041		**Sheet:** 3 of 4		
				Project Title: 14 Netherhall Gardens, London, NW3 5TQ				
				Engineer: LH		**Date:** 10/02/2012		
	m1-5 = 55.32 x 1.3 = 71.92mm/hr							
	m1-15 = 33.32 x 1.3 = 43.32mm/hr							
	m1-30 = 20.90 x 1.3 = 22.17mm/hr							
	m1-60 = 13.44 x 1.3 = 17.47mm/hr							
	m5-5 = 93.48 x 1.3 = 121.52mm/hr							
	m5-15 = 55.36 x 1.3 = 71.97mm/hr							
	m5-30 = 34.18 x 1.3 = 44.43mm/hr							
	m5-60 = 21.63 x 1.3 = 28.12mm/hr							
	m30-5 = 132.48 x 1.3 = 172.22mm/hr							
	m30-15 = 81.72 x 1.3 = 106.24mm/hr							
	m30-30 = 50.76 x 1.3 = 65.99mm/hr							
	m30-60 = 32.55 x 1.3 = 42.32mm/hr							
	m100-5 = 167.88 x 1.3 = 218.24mm/hr							
	m100-15 = 105.92 x 1.3 = 137.70mm/hr							
	m100-30 = 66.36 x 1.3 = 86.27mm/hr							
	m100-60 = 42.63 x 1.3 = 55.42mm/hr							
7) Calculate the existing peak runoff rates using the equation:								
	Q = 2.78 CiA			where:				
				Q = peak discharge (l/s)				
C_v = 0.9 (heavy clay soils)				C = dimensionless coefficient where C = C_v x C_R				
				i = rainfall intensity (mm/hr)				
C_R = 1.30 (recommended value)				A = contributing catchment area (ha)				
The contributing catchment area comprises approximately 982m^2 (0.0982ha) of existing impermeable roof and hardstanding areas.								
	m1-5 = 2.78 x 0.9 x 1.3 x 71.92 x 0.0982 = 22.97 l/s							
	m1-15 = 2.78 x 0.9 x 1.3 x 43.32 x 0.0982 = 13.84 l/s							
	m1-30 = 2.78 x 0.9 x 1.3 x 22.17 x 0.0982 = 7.08 l/s							
	m1-60 = 2.78 x 0.9 x 1.3 x 17.47 x 0.0982 = 5.58 l/s							
	m5-5 = 2.78 x 0.9 x 1.3 x 121.52 x 0.0982 = 38.81 l/s							
	m5-15 = 2.78 x 0.9 x 1.3 x 71.97 x 0.0982 = 22.99 l/s							
	m5-30 = 2.78 x 0.9 x 1.3 x 44.43 x 0.0982 = 14.19 l/s							
	m5-60 = 2.78 x 0.9 x 1.3 x 28.12 x 0.0982 = 8.98 l/s							

	Project No: 0041	Sheet: 4 of 4
POTAMOS CONSULTING	Project Title: 14 Netherhall Gardens, London, NW3 5TQ	
	Engineer: LH	Date: 10/02/2012

m30-5 = 2.78 x 0.9 x 1.3 x 172.22 x 0.0982 = 55.01 l/s
m30-15 = 2.78 x 0.9 x 1.3 x 106.24 x 0.0982 = 33.93 l/s
m30-30 = 2.78 x 0.9 x 1.3 x 65.99 x 0.0982 = 21.08 l/s
m30-60 = 2.78 x 0.9 x 1.3 x 42.32 x 0.0982 = 13.52 l/s

m100-5 = 2.78 x 0.9 x 1.3 x 218.24 x 0.0982 = 69.71 l/s
m100-15 = 2.78 x 0.9 x 1.3 x 137.70 x 0.0982 = 43.98 l/s
m100-30 = 2.78 x 0.9 x 1.3 x 86.27 x 0.0982 = 27.56 l/s
m100-60 = 2.78 x 0.9 x 1.3 x 55.42 x 0.0982 = 17.70 l/s

8) Calculate the post-development peak runoff rates using the equation:

Q = 2.78 CiA

where:

Q = peak discharge (l/s)

C_v = 0.9 (heavy clay soils)

C = dimensionless coefficient where C = C_v x C_R

i = rainfall intensity (mm/hr)

C_R = 1.30 (recommended value)

A = contributing catchment area (ha)

The post-development contributing catchment area comprises approximately 1471m^2 (0.1471ha) of impermeable areas.

m1-5 = 2.78 x 0.9 x 1.3 x 71.92 x 0.1471 = 34.41 l/s
m1-15 = 2.78 x 0.9 x 1.3 x 43.32 x 0.1471 = 20.73 l/s
m1-30 = 2.78 x 0.9 x 1.3 x 22.17 x 0.1471 = 10.61 l/s
m1-60 = 2.78 x 0.9 x 1.3 x 17.47 x 0.1471 = 8.36 l/s

m5-5 = 2.78 x 0.9 x 1.3 x 121.52 x 0.1471 = 58.14 l/s
m5-15 = 2.78 x 0.9 x 1.3 x 71.97 x 0.1471 = 34.43 l/s
m5-30 = 2.78 x 0.9 x 1.3 x 44.43 x 0.1471 = 21.26 l/s
m5-60 = 2.78 x 0.9 x 1.3 x 28.12 x 0.1471 = 13.45 l/s

m30-5 = 2.78 x 0.9 x 1.3 x 172.22 x 0.1471 = 82.40 l/s
m30-15 = 2.78 x 0.9 x 1.3 x 106.24 x 0.1471 = 50.83 l/s
m30-30 = 2.78 x 0.9 x 1.3 x 65.99 x 0.1471 = 31.57 l/s
m30-60 = 2.78 x 0.9 x 1.3 x 42.32 x 0.1471 = 20.25 l/s

m100-5 = 2.78 x 0.9 x 1.3 x 218.24 x 0.1471 = 104.42 l/s
m100-15 = 2.78 x 0.9 x 1.3 x 137.70 x 0.1471 = 65.88 l/s
m100-30 = 2.78 x 0.9 x 1.3 x 86.27 x 0.1471 = 41.28 l/s
m100-60 = 2.78 x 0.9 x 1.3 x 55.42 x 0.1471 = 26.52 l/s

Appendix G

Asset Location Search

Thames Water Property Searches
12 Vastern Road
READING
RG1 8DB

Search address supplied

Flat 1
Otto Schiff House
14
Netherhall Gardens
London
NW3 5TQ

Your reference 0041 Netherhall Gardens
Our reference ALS/ALS Standard/2012_2163868

Search date 1 February 2012

You are now able to order your Asset Location Search requests online by visiting
www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Search address supplied: Flat 1, Otto Schiff House, 14, Netherhall Gardens, London, NW3 5TQ

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

This search provides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0118 925 1504, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Tel: 0118 925 1504
Fax: 0118 923 6657

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd

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Asset Location Search

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0845 920 0800. The Customer Centre can

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Reading RG1 8DB

Asset Location Search

also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

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Asset Location Search

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Fax: 0118 923 6613
Email: developer.services@thameswater.co.uk

Should you require any further information regarding budget estimates, diversions or stopping up notices then please contact:

DevCon Team
Asset Investment
Thames Water
Maple Lodge STW
Denham Way
Rickmansworth
Hertfordshire
WD3 9SQ

Tel: 01923 898 072
Fax: 01923 898 106
Email: devcon.team@thameswater.co.uk

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No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Fax: 0208 213 8833
Email: developer.services@thameswater.co.uk

Thames Water Utilities Ltd

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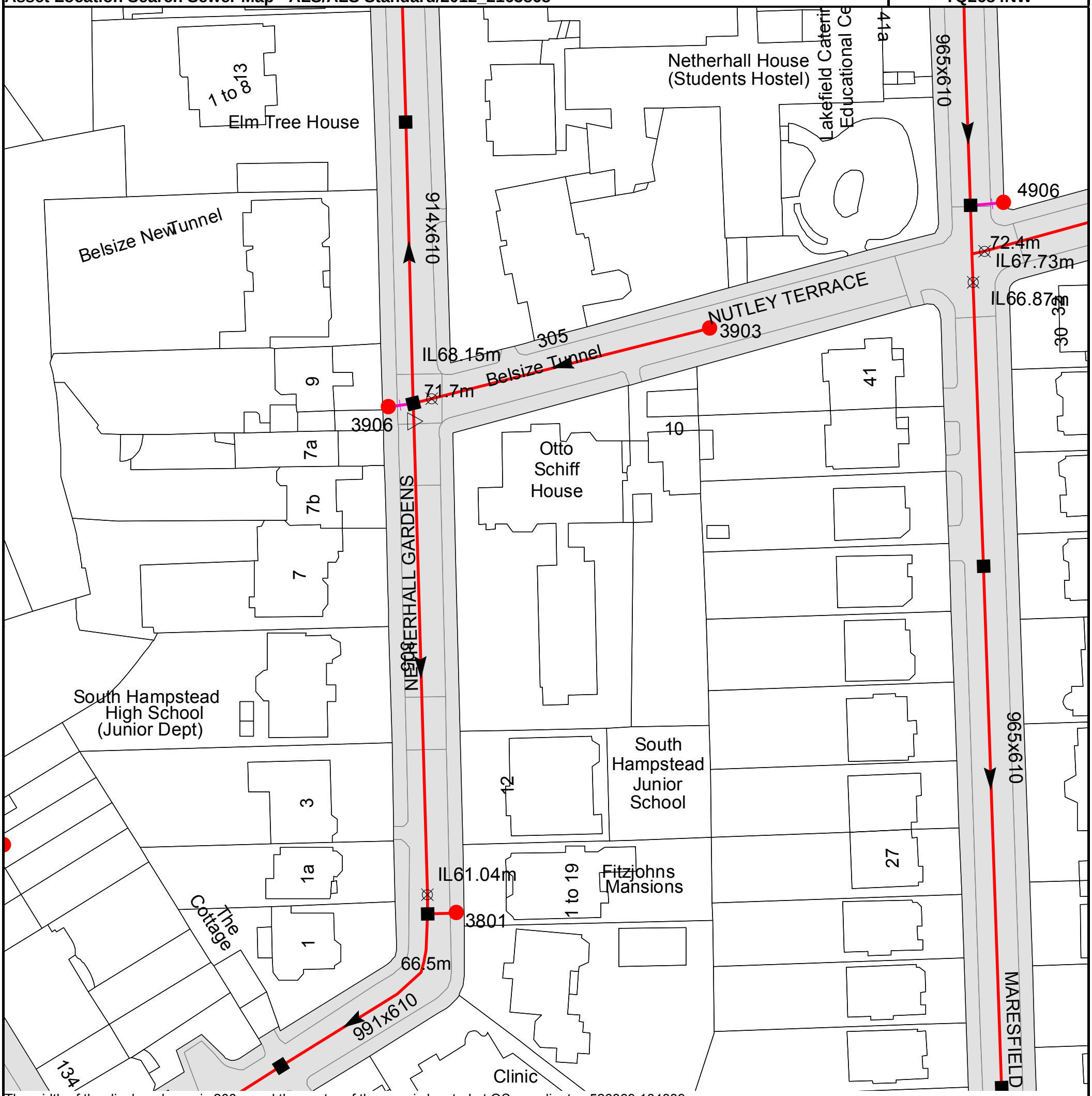
Asset Location Search Sewer Map - ALS/ALS Standard/2012_2163868 | **TQ2684NW**



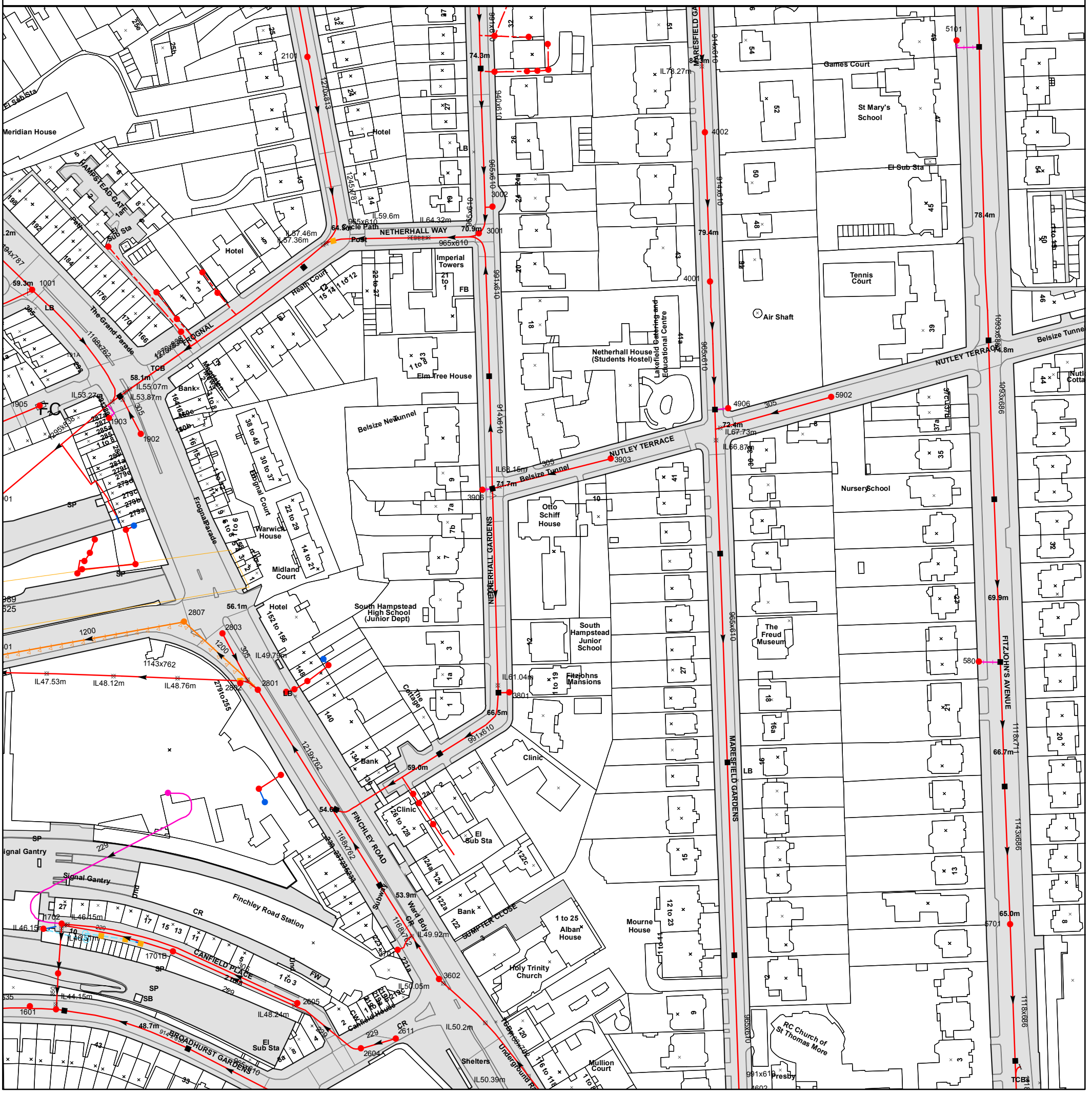
The width of the displayed area is 200m and the centre of the map is located at OS coordinates 526369,184889

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3906	n/a	n/a
3801	n/a	n/a
4906	n/a	n/a
-	-	-
3903	72.04	69.19

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2012_2163868



0 10 20 40 60 80 Meters

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 before any works are undertaken. Crown copyright Reserved

Scale:	1:1791
Width:	500m
Printed By:	DRUBINID
Print Date:	02/02/2012
Map Centre:	526368,184889
Grid Reference:	TQ2684NW

Comments:

ALS/ALS Standard/2012_2163868

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
18AH		
18AD		
18AI		
18AE		
1902	57.86	54.02
1905	58.3	55.92
1001	59.4	54.85
3602	53.34	52.43
3705		
3906		
3002		
3106		
2611	53.12	49.01
3701		
27CJ		
28CI		
28CH		
28CG		
28CE		
2807	55.9	48.57
1916		
2007		
17BC		
161A		
17BE		
1703		
2101	69.04	62.55
3110		
3108		
5902	73.36	69.41
5701	64.86	60.58
5101		
3903	72.04	69.19
4001	76.82	71.76

REFERENCE	COVER LEVEL	INVERT LEVEL
18AG		
18AJ		
18BB		
18AF		
1903		
1005		
1004		
3706		
3704		
3001	70.81	64.89
3112		
2604	52.67	48.54
2605	52.05	50.07
27CI		
27DA		
2801	55.4	49.44
2802		
28CF		
2803	55.99	52.04
2901		
2008		
1601	47.44	43.74
161B		
1702	48.6	
17BD		
701B	50.28	47.36
3111		
3109		
3107		
3801		
5801		
4906		
4002	82.58	76.52

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

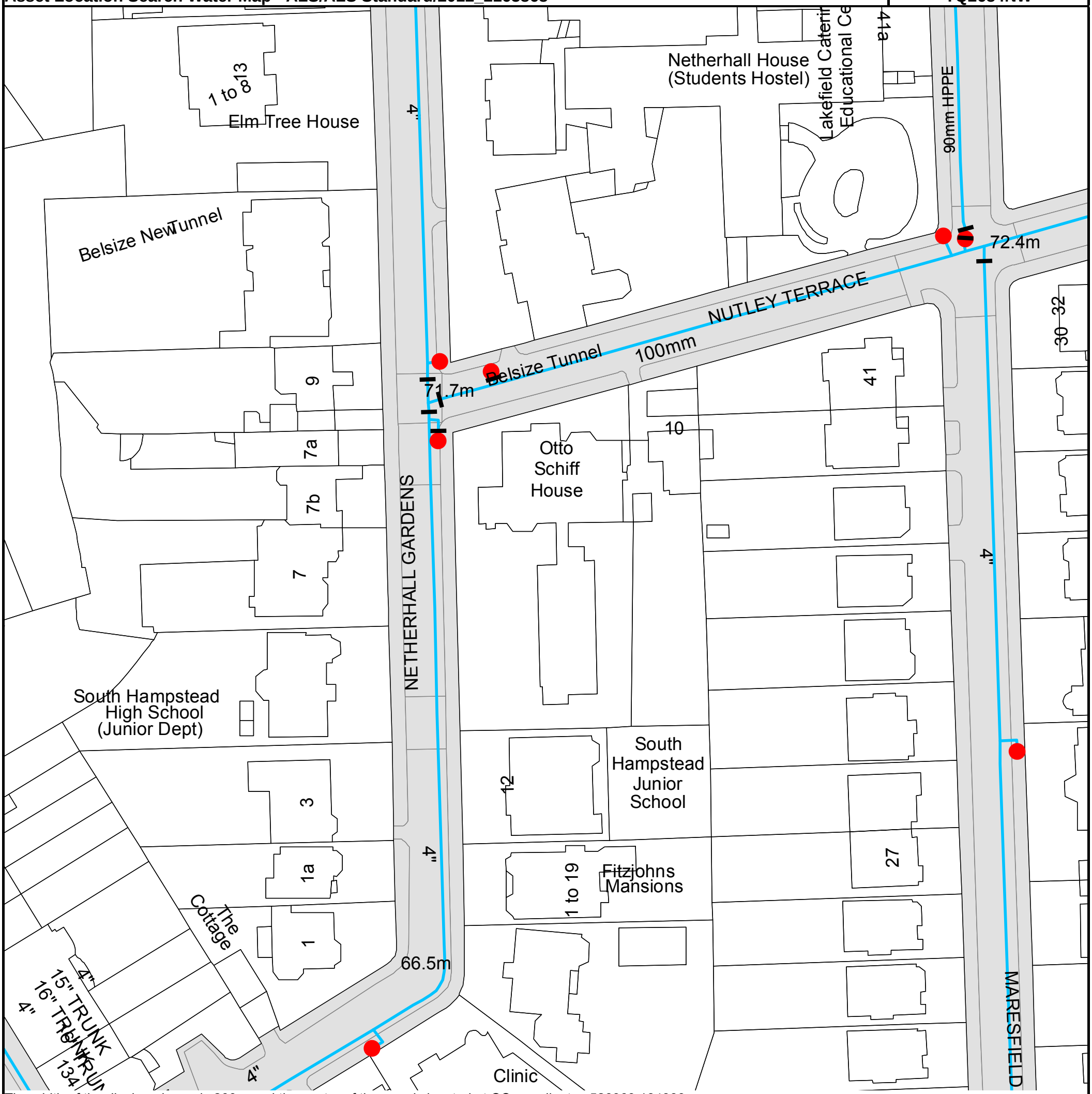
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0118 925 1504.

Asset Location Search Water Map - ALS/ALS Standard/2012_2163868 | **TQ2684NW**



The width of the displayed area is 200m and the centre of the map is located at OS coordinates 526369,184889

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Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2012_2163868

0 10 20 40 60 80 Meters

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 before any works are undertaken. Crown copyright Reserved

Scale:	1:1791
Width:	500m
Printed By:	DRUBINID
Print Date:	02/02/2012
Map Centre:	526368,184889
Grid Reference:	TQ2684NW

Comments:

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practice and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details:

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk.

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE