



Strategic Land Group

Flood Risk And Drainage Assessment

Land Off Henthorn Road, Clitheroe

880291 R1 (2)

DECEMBER 2012





RSK GENERAL NOTES

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Date: December 2012

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Date: December 2012

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Date: December 2012

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK LDE.

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1 INTRODUCTION

RSK Land and Development Engineering Ltd were commissioned to carry out a Flood Risk Assessment (FRA) for Strategic Land Group. The assessment is in support of the planning submission for the site.

The assessment has been prepared in accordance with National Planning Policy Framework (NPPF) (Ref. 1) and its accompanying guidance document (Ref. 2), the Interim Code of Practice for Sustainable Drainage (Ref. 3) and BS 8533-2011 Assessing and managing flood risk in development Code of practice (Ref. 4), with site-specific advice from the Environment Agency (EA), the Local Planning Authority, the architect and the Client.

The NPPF sets out the criteria for development and flood risk by stating that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. The key definitions are:

- “areas at risk of flooding” means land within Flood Zones 2 and 3; or land within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency
- “flood risk” means risk from all sources of flooding - including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

For this site, the key aspects that require the assessment are:

- the Environment Agency's indicative flood map (**Figure 1**) shows the site to lie within floodzone 1
- the site area is in excess of 1Ha, therefore a flood risk and drainage assessment is required.

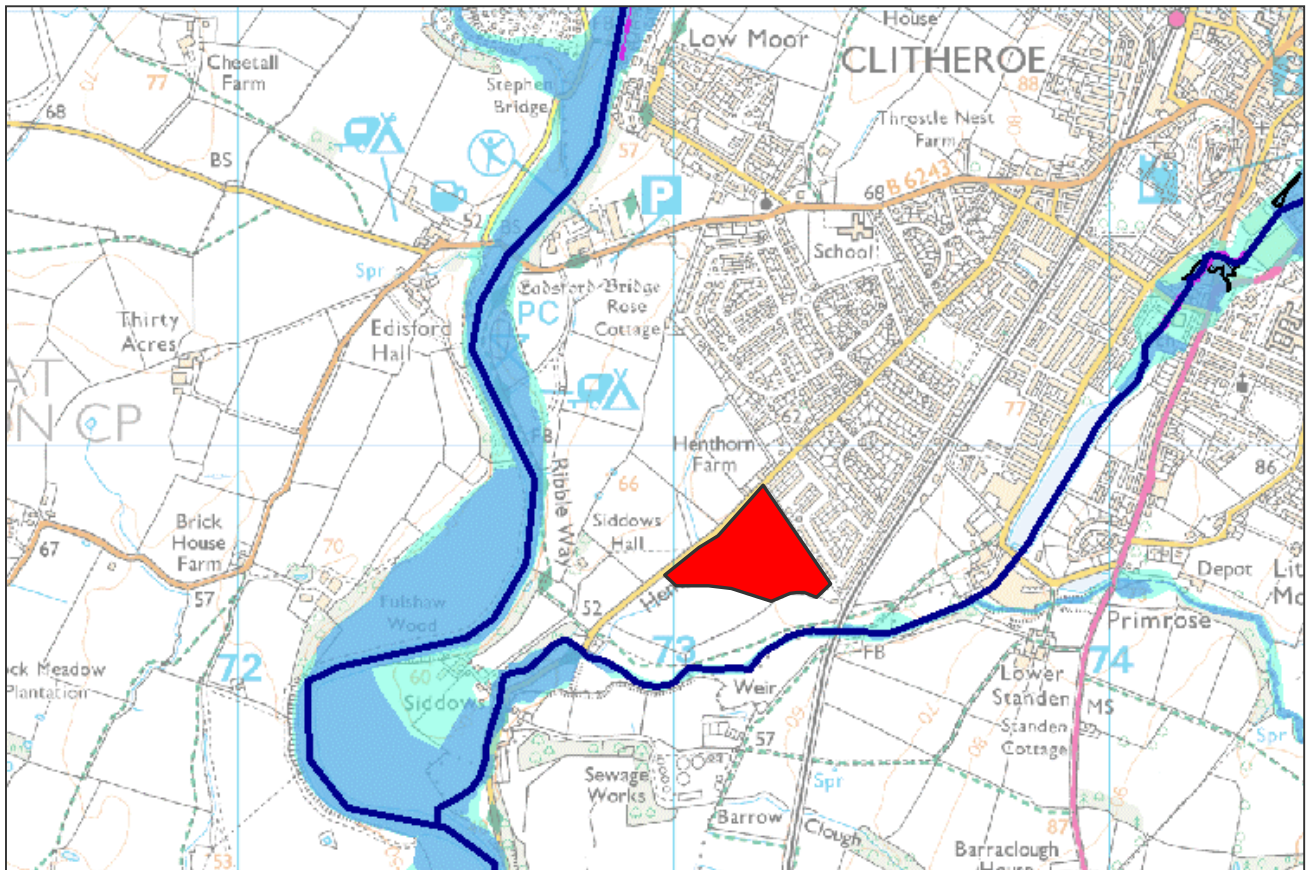


Figure 1: Environment Agency flood zone map

2 CONTEXT AND SCOPE OF WORKS

A key element of project development is to prepare a Flood Risk Assessment to establish the risk associated with the proposed development and to propose suitable mitigation, if required to reduce the risk to a more acceptable level.

The scope of work relating to a flood risk assessment is based on the guidance provided in Section 10 of NPPF (Ref. 1) and its accompanying guidance (Ref. 2).

A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. The scope of this assessment therefore comprises of the following elements:

- to obtain information on the hydrology and hydrological regime in and around the site
- to obtain the views of the EA including scope, location and impacts
- to determine the extent of new flooding provision and the influence on the site
- to review site surface water drainage based on the proposed layout. To determine the extent of infrastructure required
- to review architect plans and planning information and other studies to determine the existing site conditions
- to assess the impact on the site from climate change effects and anticipated increases in rainfall over a 100 year period for residential uses
- preparation of a report including calculations and summaries of the source information and elements reviewed.

3 SITE DESCRIPTION

3.1 Site location and description

The site is located to the south west of Clitheroe Town Centre located in a mainly rural area. The site may be located by National Grid reference SD 707 411. A site location plan is presented in **Figure 2**.

The site is bounded by:

- north – directly bounded by Henthorn Road with open fields and agricultural land beyond
- east – directly bounded by existing residential properties of Henthorn Road, Stirling Close and Kenilworth Drive. Beyond with are further residential properties.
- south – directly bounded by open fields and agricultural land beyond which is Pendleton Brook
- west – directly bounded by a drainage ditch along the northwest boundary and open fields and agricultural land beyond.

The total site area is approximately 4.97 Ha, comprising open fields. Access to the site is off Henthorn Road.

The topographical survey has been carried out and is included as **Appendix B**. The survey shows that ground levels fall in a south westerly direction from a high point of 62.40m AOD to the northern corner of the restaurant to 53.30m AOD to in the southeast corner of the site.

3.2 Development proposals

The proposals are for the development of a 140 residential dwellings, associated parking access and areas of soft landscaping.

An indicative parameter plan is included as **Appendix C** of this report.

3.3 Source protection zone

The entire site is located outside of a Source Protection Zone, according to the Environment Agency's latest groundwater designation maps.

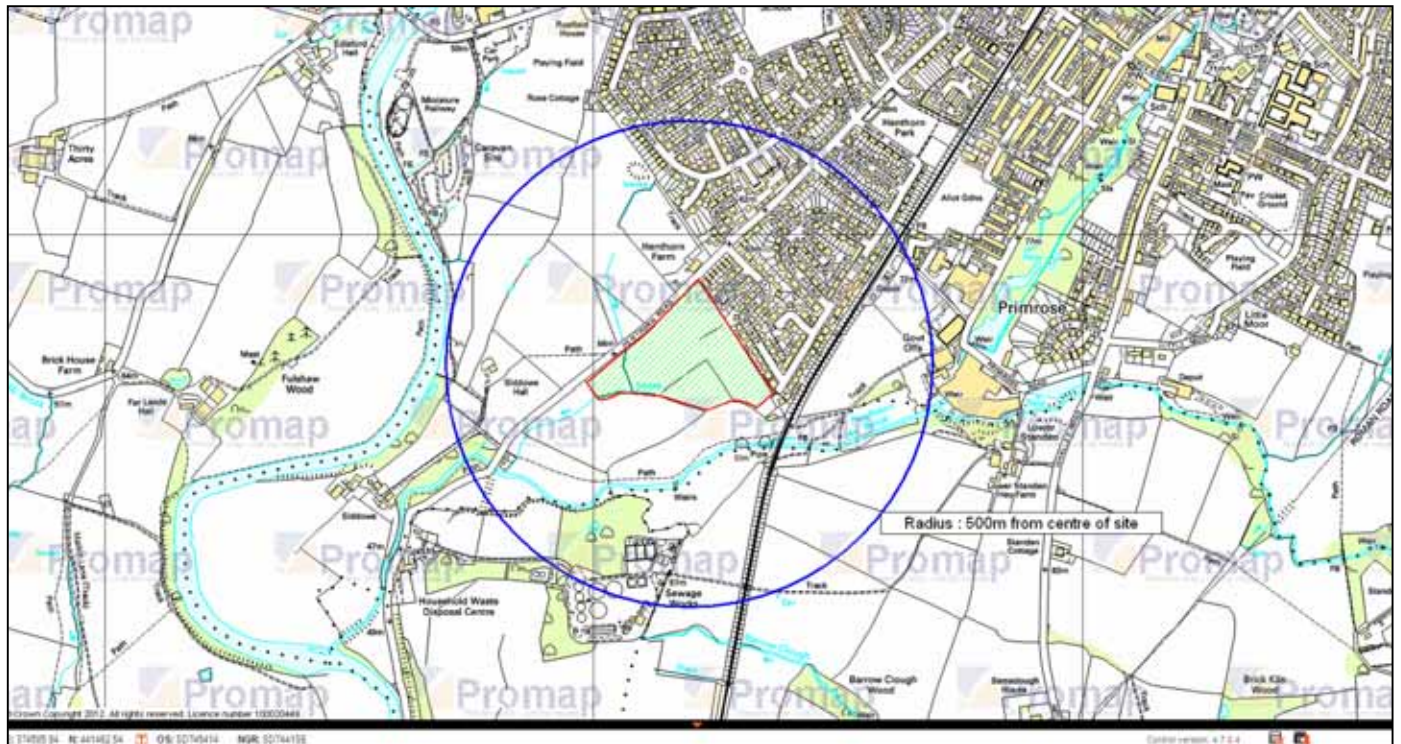


Figure 2: Site location plan

4 LEGISLATION AND POLICY CONTEXT

4.1 National

Table 4.1: National Legislation and policy context

Policy/Legislation name	Key Provisions
National Planning Policy Framework	The aims of planning policy on development and flood risk are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.
Water Resources Act 1991	<i>Section 24</i> - The Environment Agency (EA) is empowered under this Act to maintain and improve the quality of 'controlled' waters <i>Section 85</i> - It is an offence to cause or knowingly permit pollution of controlled waters <i>Section 88</i> - Discharge consents are required for discharges to controlled waters
Flood and Water Management Act 2010	This is new legislation formally ratified in September 2010. The aim is to implement the findings of the 2007 Pitt Review and co-ordinate control of drainage and flood issues. There are a number of increased responsibilities within the act that affect adoption of Sustainable Drainage Systems (SuDS) features and the role of the EA to expand on the mapping data they provide. The implementation of SuDS features has many beneficial impacts on the treatment of surface water during remediation works.
Water Framework Directive (2000)	The Water Framework Directive (WFD) came in to force in 2000 and requires all inland and coastal waters to reach 'good' chemical and biological status by 2015. Flood risk management is unlikely to have a significant impact on chemical water quality except where maintenance works disturb sediment (such as de-silting) or where pollutants are mobilised from contaminated land by floodwaters. The main impact of the WFD on flood risk management, both now and in the future, relates to the ecological quality of water bodies. Channel works, such as straightening and deepening, or flood risk management schemes that modify geomorphological processes can change river morphology. The WFD aims to protect conservation sites identified by the EC Habitats Directive and Birds Directive that have water-related features, by designating them as 'protected sites'.

5 SOURCE OF FLOOD RISK

In accordance with NPPF (Ref. 1) and advice from the Environment Agency, a prediction of the flood sources and levels is required along with the effects of climate change from the present for the design life of the development (in this case assumed to be 100 years). To consider these effects of climate change, NPPF Technical Guidance Table 5 recommends consideration of a 30% increase in rainfall intensity and 20% increase in peak river flows over this timeframe.

The flood risk elements that need to be considered for any site are defined in BS 8533 as the “Forms of Flooding” and are listed as:

- flooding from rivers (fluvial flood risk)
- flooding from the sea (tidal flood risk)
- flooding from the land
- flooding from groundwater
- flooding from sewers (sewer and drain exceedance, pumping station failure etc)
- flooding from reservoirs, canals and other artificial structures.

5.1 Environment Agency flood zone

The Environment Agency has produced Flood Zone maps for much of England and Wales. The current displayed map is reproduced as **Figure 1**. The latest Flood Zone map shows the site to be located wholly within Flood Zone 1.

5.2 Flooding from rivers (fluvial flood risk)

A number of watercourses (both Main River and Ordinary Watercourses) are located within 500m of the site boundary. Mearley Brook converges with Pendleton Brook approximately 330m to the south east of the site boundary, with Pendleton Brook flowing in a westerly direction some 75m from the southern boundary of the site (at the nearest point). Pendleton Brook flows in a westerly direction to its confluence with the River Ribble, some 775m to the south west of the site. The River Ribble flows in a north – south direction approximately 425m from its nearest point from the site boundary. Barrow Clough flows in a westerly direction 450m south of the site boundary. The watercourse flows through the sewage works, prior to flowing into the River Ribble.

A small drainage ditch flows in a southerly direction under Henthorn Road, crossing a section of the west of the site where it converges with a further drainage ditch forming the south western boundary of the site. This ditch then flows towards Pendleton Brook.

Due to the local topography of the site and the surroundings, the site is not at risk of flooding from these watercourses.

5.3 Flooding from the sea (tidal flood risk)

On the coast storm surges and high tides can threaten low lying coastal areas, and can be sometimes large and rapid enough to overtop defence works, causing significantly more damage than river flooding. However, tidal flooding is not considered a risk to the site.

5.4 Flooding from the land (overland pluvial flood risk)

If intense rain is unable to soak into the ground or be carried through man made drainage systems, for a variety of reasons, it can run off over the surface causing localised floods before reaching a river or other watercourse.

Generally, where there is impermeable surfacing or where the ground infiltration capacity is exceeded, surface water runoff will occur. Excess surface water flows from the site are believed to drain naturally to the local water features, either by overland flow or through infiltration. Due to the topography of the site, overland flow could be an issue on the site. There is no evidence, however, that pluvial or overland flooding will affect the site. Flooding from this source is considered low and will be considered within the layout of the site, ensuring the development is not at increased risk and overland flow routes will be created within the design of the site to ensure properties are not at risk of flooding from this source.

5.5 Flooding from groundwater

Groundwater flooding tends to occur after much longer periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Groundwater tends to flow from areas where the ground level is high, to areas where the ground level is low. In low-lying areas the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). These may be extensive, regional aquifers, such as Chalk or sandstone, or may be localised sands or river gravels in valley bottoms underlain by less permeable rocks. Groundwater flooding takes longer to dissipate because groundwater moves much more slowly than surface water and will take time to flow away underground.

According to the RVBC Strategic Flood Risk Assessment (Ref. 5), This is not considered by the Environment Agency to be a significant flood risk factor in the RVBC area.

5.6 Flooding from sewers

Most adopted surface water drainage networks are designed to the criteria set out in Sewers for Adoption (Ref. 6). One of the design parameters is that sewer systems be designed such that no flooding of any part of the site occurs in a 1 in 30 year rainfall

event. By definition a 1 in 100 year event would exceed the capacity of the surrounding sewer network as well as any proposed drainage.

According to the latest United Utilities sewer records (**Appendix D**), an adopted sewerage network is located within and surrounding the site boundary. A 1100 x 675mm combined sewer flows along Henthorn Road (in a south westerly direction) and crosses the site towards the south east corner of the site, where a number of networks join to cross the watercourse, to the south east of the site.

According to the Lancaster PFRA (Ref. 7) an initial data collection exercise revealed nearly 420 past flood incidents across the area from local authority records. In addition, interrogation of the United Utilities Sewer Incident Record System (SIRS) database uncovered a further 32 incidents of flooding due to the sewer system capacity being exceeded. The majority of these incidents related to flooding of minor roads or single properties. Examination of this data shows clusters of flood risk in key locations around the area, most notably in Lancaster/Morecambe, Blackpool, Preston and Bacup/Rawtenstall in Rossendale.

The historical data suggest that the risk of flooding from sewers and the drainage system is low.

5.7 Flooding from reservoirs, canals and other artificial structures

The Environment Agency has recently published flood mapping as a result of potential failure of reservoirs. This map shows the site is not in an area at risk of flooding from this source. There are no other known structures in the vicinity of the site that could pose a flood risk to the site.

The site is not thought to be at risk from this source, therefore the flood risk to the site from reservoirs, canals and other artificial structures is low.

5.8 Historic flooding

According to data obtained from the RVBC Strategic Flood Risk Assessment (Ref. 5) there is no known historic flooding of the site or the surrounding area.

6 SURFACE WATER DRAINAGE ASSESSMENT

6.1 Scope

A drainage strategy has been carried out to identify the options for the design of the surface water drainage system and how it will affect the site layout using the following data:

- estimate the discharge rate for the site. Greenfield discharge rates should be sought on greenfield sites, and also on brownfield sites (where possible)
- estimate the volume of 1 in 100 year attenuation to be provided
- take into account the latest climate change requirements.

6.2 Pre-development situation

Surface water flows from the existing site are believed to drain naturally, with no on site drainage channels or formal surface water infrastructure serving the site.

In terms of estimating the potential runoff from the site, the ICP SuDs method (Ref. 3) has been used to estimate the existing runoff from the site in its current condition (See **Appendix E** for full calculations sheet).

Return Period	Peak flow
QBAR	38.4 l/sec
1 in 1 year peak flow	33.4 l/sec
1 in 30 year peak flow	65.2 l/sec
1 in 100 year peak flow	80.0 l/sec

TABLE 6.1: ICP SuDs Surface Water runoff calculations

It is essential that the volume of runoff generated as a result of the development of the site should either remain the same as the existing discharge rate or be reduced. Preferably the discharge rate should be restricted to near the greenfield runoff rate if possible, by combining the use of SuDS onsite where feasible.

Generally any drainage system for the site should, therefore be designed such that peak flows are to be restricted to a maximum of 80.0l/sec for the 1 in 100-year rainfall event including a 30% allowance for climate change to replicate or improve the current discharge. Should it be found that discharge off site be to sewer or to watercourse, then the discharge will be limited to the greenfield runoff rates. It is also anticipated that any surface water drainage system will be designed to the latest best practice.

Surface water flows from the existing site are believed to drain naturally, with no on site drainage channels or formal surface water infrastructure serving the site.

6.3 Pre-development situation

The existing site is classified as greenfield and as such the existing surface water run-off from such either naturally infiltrates, ponds or runs of via surface or subsurface flows towards the drainage ditches located to the west of the site.

6.4 Off site discharge options

An order of preference exists for drainage receptors. Infiltration drainage should be used where possible. Where this is not possible, or does not provide sufficient capacity, attenuated discharge to watercourses should be sought. Only where neither of these two options is available should discharge to sewers be considered, subject to approvals from the sewerage undertaker.

6.4.1 Infiltration

Discharge to the ground, or infiltration, may be a possible drainage solution for this site; however the effectiveness of infiltration is completely dependent on the physical conditions at the site. Potential obstacles include:

Local variations in permeability preventing infiltration - This testing should be undertaken in line with the guidance contained in BRE 365 (Ref. 8) or CIRIA R156 (Ref. 9) and the results used to firstly check feasibility and secondly to size the necessary infiltration features.

Shallow groundwater table - For infiltration drainage devices Building Regulation approved document H2 states that these, "should not be built in ground where the water table reaches the bottom of the device at any time of the year".

Source Protection Zones - As discussed in Section 3, the site is not located in a source protection zone. If the local ground conditions prove suitable, water could be infiltrated to the ground in a number of different ways, including discharge to infiltration trenches, retention ponds designed to infiltrate water or more laterally extensive systems constructed beneath roadways.

6.4.2 Discharge to watercourse

Should it be found that infiltration is not suitable on the site, discharge to watercourse is the next option to consider. A number of small drainage ditches are located within the site boundary. These ditches receive run-off from the site, pre-development and any discharge to these ditches will be limited to the pre-development run-off rates as stated in Table 6.1.

6.4.3 Discharge to sewer

This option should only be pursued should infiltration or discharge to watercourse not be feasible.

A sewer crosses the site and may be suitable to receive surface water.

6.5 SuDs drainage principles

It is intended that a SuDs based system will be utilized on the site. A SuDs system aims to mimic natural systems whereby water is held close to the source, then released slowly over time. This acts to both reduce peak discharge and to promote the settlement of sediment thereby improving the water quality of any resulting discharge.

The final sustainable drainage strategy for this site will be designed in line with the SuDS management train. This requires that;

1. Source control techniques such as permeable paving, green roofs and rainwater harvesting are incorporated into the development design wherever reasonably possible
2. Where appropriate infiltration drainage is encouraged
3. In situations where infiltration is not possible to discharge all surface water to the ground, storm water will be controlled and discharged as locally as possible with excess storm water stored on the site in surface water features
4. Off site solutions and hard engineering to achieve the design criteria will only be considered where it can be demonstrated that more sustainable options above are not possible.

6.6 Post-development situation

A SuDS based system will be utilised on site to attenuate and discharge the generated surface water from the impermeable surfaces. WINDES (W12.5) has been used to determine the volume of attenuation required on the site and has been designed for the 1 in 100-year rainfall event including a 30% allowance for climate change based on the 1 in 100-year predevelopment run-off rate of 80.0l/s. All surface water generated from impermeable surfaces will gravitate towards an attenuation facility sized to accommodate flows in excess of the permitted run-off rate. An approximate attenuation volume of 885.5m³ for the design rainfall event (1 in 100-years including an allowance for climate change) has been determined (**Appendix F**) based on an impermeable area of 50% of the total site area. The exact design of the system should be determined in the detailed design stage and approved by the relevant bodies prior to construction on site, this will also be subject to infiltration testing.

7 PLANNING CONTEXT

7.1 Application of planning policy

NPPF includes (Section 10) measures specifically dealing with development planning and flood risk using a sequential characterisation of risk based on planning zones and the EA Flood Map. The main study requirement is to identify the flood zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

Within NPPF Technical Guidance on flood risk each flood zone has a list of appropriate land uses dependent on vulnerability to flooding.

7.2 Land use vulnerability

From the NPPF Technical Guidance, a “less vulnerable” land use could be appropriate to Flood Zone 3a (High Probability of flooding at higher than 1 in 100 annual probability) with the “more vulnerable” use only permitted if the exception test is passed. For a “more vulnerable” class, development on this site could be appropriate within Flood Zone 2 (Medium Probability of flooding at less than 1 in 100 but higher than 1 in 1,000 annual probability).

In applying the sequential test, reference is made to the following table (reproduced from Table 3 contained within NPPF).

Table 6.1: Flood risk vulnerability and flood zone ‘compatibility’

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	Appropriate	Appropriate	Appropriate	Appropriate	Appropriate
	Zone 2	Appropriate	Appropriate	Exception Test Required	Appropriate	Appropriate
	Zone 3a	Exception Test Required	Appropriate	Should not be permitted	Exception Test Required	Appropriate
	Zone 3b functional floodplain	Exception Test Required	Appropriate	Should not be permitted	Should not be permitted	Should not be permitted

The proposed use as a residential development can be classed as ‘more vulnerable’ and therefore appropriate in Flood Zone 1.

7.3 Sequential and exception tests

The Sequential Test is required to assess flood risk and NPPF Technical Guidance recommends that the test be applied at all stages of the planning process to direct new development to areas with the lowest probability of flooding (Flood Zone 1).

According to NPPF, if there is no reasonably available site in Flood Zone 1, the flood vulnerability of the proposed development (see NPPF Technical Guidance Table 2) can be taken into account in locating development in Flood Zone 2 and then Flood Zone 3. Within each Flood Zone new development should be directed to sites at the lowest probability of flooding from all sources.

The development proposal includes 'more vulnerable' residential uses to be developed on this site. With reference to Table 6.1 above, this development would be appropriate for areas within Flood Zone 1. It is not proposed to develop within Flood Zones 2 and 3.

The proposed development is classified as 'More Vulnerable' and therefore permitted within Flood Zone 1, subject to an appropriate surface water drainage strategy. The proposed development passes the sequential test and does not require the Exception Test.

8 CONCLUSIONS AND RECOMMENDATIONS

This flood risk assessment has been prepared in support of the proposed residential development at Land Off Henthorn Road, Clitheroe.

The site is located within Flood Zone 1 according to the latest Environment Agency flood zone maps, indicating that the site is not at risk from fluvial or tidal sources. Suitable mitigation can be incorporated to ensure that flood risk to the proposed properties remains low and meets the requirements of the NPPF.

Data obtained from the SFRA also places the site at low risk of flooding from other sources. In accordance with the NPPF and local policy, this FRA has considered the impact on the surface water regime in the area should development occur.

Development of the site should be possible with careful consideration of the surface water and foul drainage, as well as other possible flooding issues. The proposals should balance the flood storage volumes and should not impede overland flows. Further details on the drainage design and layout will be subject to further investigation.

Based on the information available the **flood risk to the proposed development is low** and development should not be precluded on flood risk grounds.

9 REFERENCES

1. Communities and Local Government “National Planning Policy Framework” NPPF, March 2012.
2. Communities and Local Government “Technical Guidance to the National Planning Policy Framework”, March 2012.
3. DEFRA “Interim Code of Practice for Sustainable Drainage Systems” National SUDS Working Group, July 2004.
4. BS 8533-2011 Assessing and managing flood risk in development Code of practice, November 2011.
5. Ribble Valley Level 1 Strategic Flood Risk Assessment. Adoption Report, May 2010.
6. WRC “Sewers for Adoption” 6th Edition, 2006.
7. Lancashire Area Preliminary Assessment Report. May 2011.
8. BRE 365, Soakaway Design
9. Infiltration drainage – Manual of good practice. C156.



APPENDICES



APPENDIX A

RSK SERVICE CONSTRAINTS

1. This report is carried out in connection with the report (together the "Services") were compiled and carried out by RSK LDE Ltd (RSK) for Strategic Land Group (the "client") in accordance with the terms of a contract between RSK and the "client". The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable Civil Engineer at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.
2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date hereof, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services, which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.
8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site.



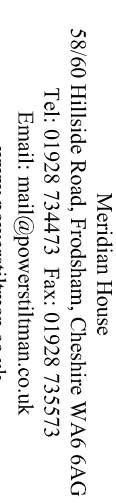
APPENDIX B

EXISTING SITE SURVEY

[illegible]

KEY DIMENSIONS SHOULD BE CHECKED ON SITE BEFORE COMMENCEMENT OF ANY WORKS

NOTE



Land Off Henthorn Road

Topographical Survey

Client: **Bowsall Ltd**

by : DG	Date : 01/06/1
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DG	Drawing No.:
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APPENDIX C

INDICATIVE PARAMETER PLAN



HENTHORN ROAD LANDSCAPE FRAMEWORK



APPENDIX D

UNITED UTILITIES SEWER RECORDS

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Dear Sirs

Location: Henthorn Road Clitheroe BB7 2LD

I acknowledge with thanks your request dated 24/05/12 for information on the location of our services.

Please find enclosed plans showing the approximate position of our apparatus known to be in the vicinity of this site.

I attach General Condition Information sheets, which details contact numbers for additional services (i.e. new supplies, connections, diversions) which we are unable to deal with at this office. In addition you should ensure they are made available to anyone carrying out any works which may affect our apparatus.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please telephone us on 0870 7510101.

Yours Faithfully,



Sue McManus
Operations Manager
Property Searches

United Utilities Water PLC

Property Searches
Ground Floor Grasmere House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP

DX 715568 Warrington
Telephone 0870 751 0101
Fax Number 0870 7510102

Property.searches@uuwplc.co.uk

Your Ref: HENTHORN ROAD - CLITHEROE
Our Ref: 12/ 871593
Date: 12/06/2012

TERMS AND CONDITIONS - WASTERWATER & WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UW apparatus) of United Utilities Water PLC ("UW").

TERMS AND CONDITIONS:

1. This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
2. This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
3. In particular, the position and depth of any UW apparatus shown on the Map are approximate only. UW strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UW apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
4. The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
5. The position and depth of UW apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
6. This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UW apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
7. No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UW apparatus by reason of the actual position and/or depths of UW apparatus being different from those shown on the Map and any information supplied with it.
8. If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and effect.
9. This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UW from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

These general conditions and precautions apply to the wastewater network of United Utilities.

Please ensure that a copy of these conditions is passed to your representative and contractor on site.

1. United Utilities provides the approximate locations of its sewers according to its records. These records are not necessarily accurate or complete nor do they normally show the positions of every sewer culvert or drain, private connections from properties to the public sewers or the particulars of any private system. No person or company shall be relieved from liability for any damage caused by reason of the actual positions and/or depths being different from those indicated. The records do indicate the position of the nearest known public sewer from which the likely length of private connections can be estimated together with the need for any off site drainage rights or easements.
2. Special requirements relative to our sewers may be indicated. United Utilities employees or its contractors will visit any site at reasonable notice to assist in the location of its underground sewers and advise any precautions that may be required to obviate any damage. To arrange a visit or for further information regarding new supplies, connections, diversions, costing, or any notification required under these General Conditions, please call us on **0845 746 2200**.
3. Where public sewers are within a site which is to be developed and do not take any drainage from outside the area, they are from an operational viewpoint redundant. The developer must identify all redundant sewers affected by the development and apply to United Utilities in writing for these sewers to be formally closed. The developer shall bear all related costs of the physical abandonment work.
4. Public sewers within the site that are still live outside the area, will be subject to a "Restricted Building zone". This would normally be a surface area equivalent to the depth of the sewer measured from the centre line of the sewer on either side. No construction will be permitted within that zone. The developer should also note that deep and wide rooted trees must not be planted in close proximity to live sewers. Access to public sewers must be maintained at all times and no interference to manholes will be permitted during construction work.
5. Where there is a public sewer along the line of a proposed development/building, arrangements shall be made by the developer at his cost to divert the sewer around the development. Where this is not possible and as a last resort, a "Building Over Agreement" will need to be completed under section 18 of the Building Act 1984. The developer shall design building foundations to ensure that no additional loading is transferred to the sewer and submit such details both to the Local Authority's Building Control Officer and to United Utilities for approval/acceptance. United Utilities on a rechargeable basis would normally undertake all aspects of design work associated with the diversion of any part of the operational wastewater network.
6. Where there is a non-main river watercourse/culvert passing through the site, the landowner has the responsibility of a riparian owner for the watercourse/culvert and is responsible for the maintenance of the fabric of the culvert and for all works involved in maintaining the unrestricted flow through it. Building over the watercourse/culvert is not recommended. The developer must contact the local authority before any works are carried out on the watercourse/culvert. Where it is necessary to discharge surface water from the site into the watercourse/culvert the developer shall make an assessment of the available capacity of the watercourse/culvert (based on a 1 in 50 year event) and ensure that the additional flow to be discharged into the watercourse/culvert will not cause any flooding. In appropriate cases, flooding may be prevented by on-site storage. The developer shall submit the relevant details required to substantiate his development proposals. Details of any outfall proposed shall also be submitted to the Environment Agency, PO Box 12, Richard Fairclough House, Knutsford Road, Warrington, Cheshire, WA4 1HT for their approval.
7. Where there is a main river watercourse/culvert passing through the site, the developer shall submit all proposals affecting the river to the Environment Agency at the address stated in paragraph 6 for approval/acceptance.

8. Your attention is drawn also to the following:

- **Private drains or sewers which may be within the site.**

United Utilities has no duty to keep records of private drains and sewers, and there are no comprehensive records kept elsewhere. Local Authority Building Control Officers may have records of recent developments and they or the developer may be able to provide information in this respect.

- **Applications to make connections to the public sewer.**

The developer must write to United Utilities requesting an application form that must be duly completed and returned. No works on the public sewer shall be carried out until a letter of consent is received from United Utilities.

- **Sewers for adoption.**

If an agreement for the adoption of sewers under Section 104 of the Water Industry Act 1991 is being contemplated, a submission in accordance with "Sewers for Adoption", Fifth Edition, published by the Water Research Centre (2001) Plc, Henley Road, Medmenham, PO Box 16, Marlow, Buckinghamshire, SL7 2HD will be required, taking into consideration any departures from the general guide stipulated by United Utilities.

- **Further consultation with United Utilities.**

Developers wishing to seek advice or clarification regarding sewer record information provided should contact United Utilities to arrange an appointment. A consultation fee may be charged, details of which will be made available at the time of making an appointment.

9. Combined sewers, foul sewers, surface water sewers, and pumped mains. These are shown separately in a range of colours or markings to distinguish them on our drawings, which are extracts from the statutory regional sewer map. A legend and key is provided on each extract for general use, although not all types of sewer will be shown on every extract.

Combined sewers shown coloured red carry both surface water and foul sewage, especially in areas where there is no separate surface water sewerage system.

Foul sewers coloured brown may also carry surface water and there may be no separate surface water system indicated in the immediate area. Both combined and foul sewers carry wastewater to our treatment works before it can safely be returned to the environment.

Surface water sewers coloured blue on our drawings are intended only to carry uncontaminated surface water (e.g. rainfall from roofs, etc) and they usually discharge into local watercourses. It is important for the protection of the environment and water quality that only uncontaminated surface water is connected to the surface water sewers. Improper connections to surface water sewers from sink wastes, washing machines and other domestic use of water can cause significant pollution of watercourses.

Pumped mains, rising mains and sludge mains will all be subject to pumping pressures and are neither suitable nor available for making new connections.

Highway drains, when included, show as blue and black dashed lines. Highway drains are not assets belonging to United Utilities and are the responsibility of local authorities.

10. For information regarding future proposals for construction of company apparatus please write to United Utilities, PO Box 453, Warrington, WA5 3QN.

11. For information regarding easements, deeds, grants or wayleaves please write to United Utilities Property Solutions, Coniston Buildings, Lingley Mere Business Park, Lingley Green Avenue, Great Sankey, Warrington WA5 3UU (**Tel: 01925 463 654**).



United Utilities Water PLC
Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington WA5 3LP
www.unitedutilities.com

Registered in England and Wales Registered Number 2366678

These general conditions and precautions apply to the water distribution system of United Utilities.

**Please ensure that a copy of these conditions is passed to
your representative and contractor on site.**

1. United Utilities provides approximate locations of its water mains or apparatus according to its records. These records are not necessarily accurate or complete nor do they normally show the positions of private service pipes from the mains to properties. Where service pipes are shown, a blue broken line indicates their approximate position. No person or company shall be relieved from liability for any damage caused by reason of the actual positions and/or depths being different from those indicated.
2. Special requirements relative to our apparatus may be indicated. United Utilities employees will visit any site at reasonable notice to assist in the location of its underground water apparatus and advise any precautions that may be required to obviate any damage. To arrange a visit or for further information regarding new supplies, connections, diversions, costing, future proposals for construction of company apparatus or any notification required under these General Conditions, please telephone us on **0845 746 2200** or write to United Utilities, PO Box 453, Warrington, WA5 3QN.
3. In order to achieve safe working conditions adjacent to any water apparatus the following should be observed;
 - (a) All water apparatus should be located by hand digging prior to the use of mechanical excavation.
 - (b) During construction work where heavy plant may have to cross the line of a water main, and the main is not under a carriageway of adequate standard of construction, crossing points should be suitably reinforced with sleepers, steel plates or a specially constructed reinforced concrete raft as necessary. These crossing points should be clearly indicated and crossing the line of the water main at other places should be prevented. United Utilities employees will advise on the type of reinforcement necessary. This is particularly important on agricultural or open land, where tilling or erosion may have significantly reduced the original cover.
 - (c) No explosive should be used within 32 metres of any United Utilities apparatus without prior consultation with United Utilities.
 - (d) Where it is proposed to carry out piling within 15 metres of any water main United Utilities should be consulted so that the affected main may be surveyed.
4. During any excavation, it is important that measures should be taken to ensure continued support for any water main:
 - (a) Where excavation of trenches adjacent to any water main is likely to affect its support, the main must be supported to the satisfaction of United Utilities.
 - (b) Where a trench is excavated crossing or parallel to the line of a water main, the backfill should be adequately compacted to prevent any settlement which could subsequently cause damage to the main. In special cases it may be necessary to provide permanent support to a main which has been exposed over the length of the excavation before back-filling and reinstatement is carried out. No back-filled concrete should contact the main.
5. No other apparatus should be laid over and along the line of a water main irrespective of clearance. A minimum clearance of 450 millimetres should be allowed between any plant being installed and an existing main, to facilitate maintenance and repair, whether the adjacent plant is parallel to or crossing the main. No manhole, chamber, or other obstruction should be built over or around a water main.
6. Where a water main is coated with special wrapping and the wrapping is damaged, even to a minor extent, United Utilities must be notified, and the excavation must be left open for ready access so that repairs can be made. In case of any material damage to the main itself causing leakage, or weakening of the mechanical strength of the pipe, the person or body responsible should immediately notify United Utilities in order that the necessary remedial work can be carried out. The full cost of the necessary remedial work will be charged to the person or body responsible for the damage.

7. If you propose to change existing levels over water mains you will need to inform us. We will need specific locations to be identified together with precise details as to the scale of the proposed changes to existing ground levels. Changes to existing levels may require the diversion of our apparatus at your cost. However, in certain circumstances we may wish to leave our apparatus where it is. On these occasions you will usually be required to protect our apparatus by means of a concrete raft and either raise or lower any surface boxes affected.
8. Under no circumstances should our surface boxes be either buried or left in a situation where they are raised above finished ground levels. You should re-use and re-set any surface boxes affected by your works into the new surface so that they align over the water apparatus below. You will be responsible for the cost of repairing any damage to our apparatus as a result of your works.
9. Where proposals involve resurfacing, you must notify United Utilities if your excavation will be greater than 750mm in the highway and 300mm in a footpath, verge or other location.
10. For information regarding easements, deeds, grants, licences or wayleaves, please write to United Utilities Property Solutions, Coniston Buildings, Lingley Mere Business Park, Lingley Green Avenue, Great Sankey, Warrington WA5 3UU (**Tel: 01925 463 654**).

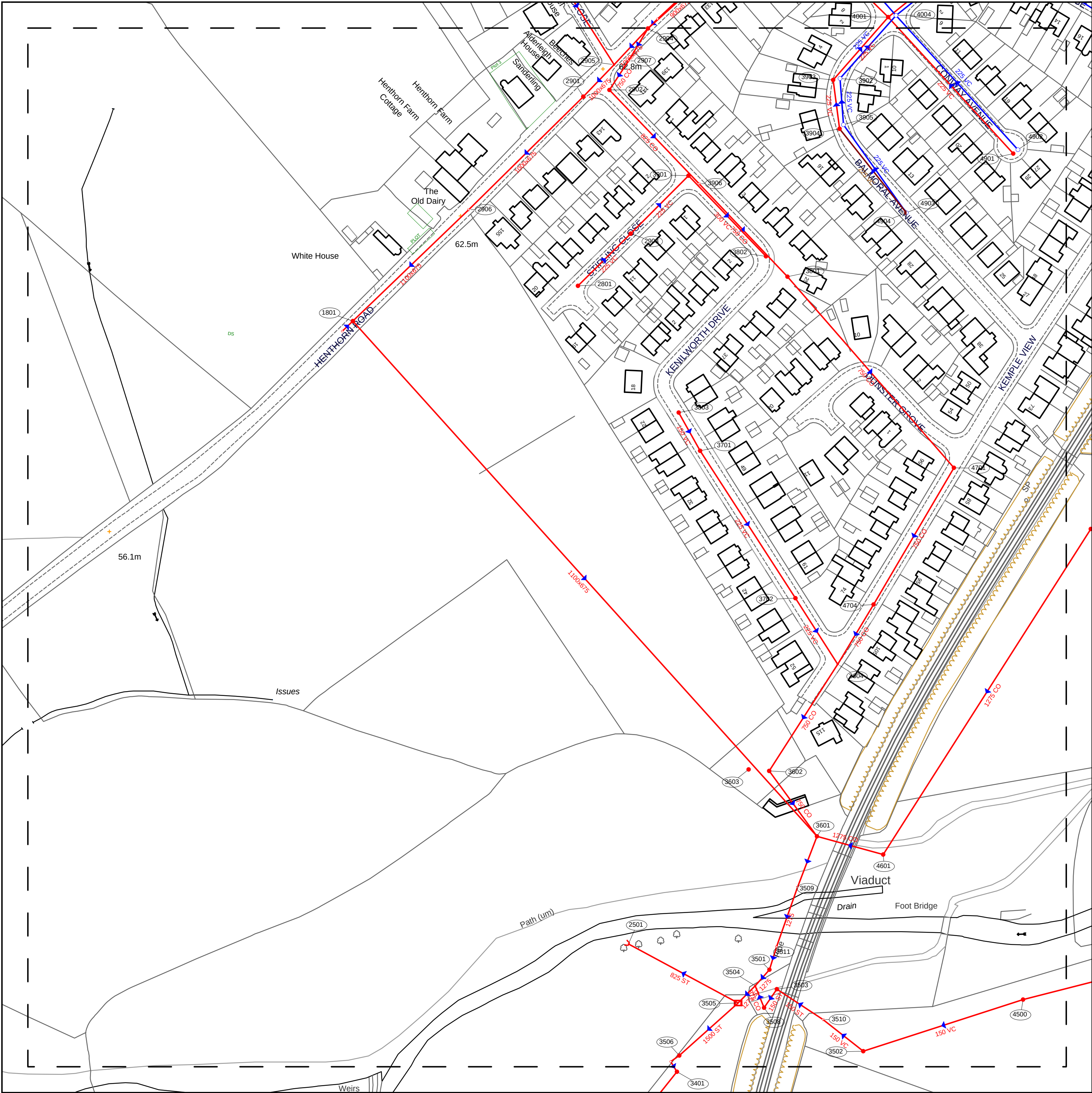
Tree planting restrictions over water mains

- a) Poplar and willow trees have extensive root systems and should not be planted within 10 metres of any water main.
- b) The following trees and those of a similar size, whether they are deciduous or evergreen, should not be planted within six metres of any water main:
 - Ash, beech, birch, elm, horse chestnut, lime, oak, sycamore;
 - Apple trees and pear trees;
 - Most conifers.
- c) United Utilities requires access to the route of its mains at all times to inspect for leaks and carry out surveys. We recommend that no shrubs or bushes which might obstruct or interfere with our access should be planted within one metre of the centre line of any water main.
- d) There may be instances when both United Utilities and the landowner will wish to plant shrubs or bushes close to the water main for screening or other purposes. The following shallow rooting shrubs would be suitable for this purpose:
 - Blackthorn, broom, cotoneaster, elder;
 - Hazel, laurel, privet, quickthorn, snowberry;
 - Most ornamental flowering shrubs.
- e) In areas where soft fruit is grown, blackcurrant, raspberries and gooseberries may be planted close to the main, provided that a path is left clear for inspection access and surveys. United Utilities can give additional advice where required in particular circumstances.



United Utilities Water PLC
Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington WA5 3LP
www.unitedutilities.com

Registered in England and Wales Registered Number 2366678



OS Sheet No: SD7340NW
Scale 1:1250 Date: 12-Jun-2012

Printed by: Angela Gall

WASTE WATER SYMBOLOLOGY

- Foul
MANHOLE
- Surface
MANHOLE
- Combined
MANHOLE
- Dual
MANHOLE
- Side Entry
MANHOLE
- PRIVATE SEWER
- ABANDONED SEWER
- SITE TERMINATION
- AIR VALVE
- CASCADE
- CONTROL KIOSK
- CONTROL VALVE
- GULLY
- HATCHBOX
- HEADWALL
- HYDROBRAKE
- INLET
- GHOST NODE (inc. GN - Rising Main & GN - Dual Function)
- EXPENDIENCY NODE (CHANGE OF CHARACTERISTIC)
- CATCHPIT
- CHAMBER
- DROPSHAFT
- SHEET EDGE
- SEWER OVERFLOW
- TANK
- PUMPING STATION
- SLUDGE PUMPING STATION
- SIDE ENTRY CATCHPIT
- SIDE ENTRY CHAMBER
- SIDE ENTRY DROPSHAFT
- VENT COLUMN
- DISCHARGE POINT (OUTFALL)
- WASTE WATER TREATMENT WORKS
- EJECTOR STATION

T-JUNCTION (SADDLE)

LAMP HOLE

OIL INTERCEPTOR

PENSTOCK

RODDING EYE

SOAKAWAY

TUMBLING BAY

UNSPECIFIED

VALVE

WASHOUT

Note - ALL flow direction arrows are BLUE - colour not significant

Refno Cover Func Type Invert Size.xSize.y ShapeMatl Grad Length

1801	60.19	C	M	58.39	1100	675	E		333.73
1802		C	G			150	C	VC	7.02
2501		O	F						
2801	63.2	C	M	61.9	225		C	VC	99 35.72
2901	62.88	C	M	58.75	1000	675	E	455	77.43
2902	62.95	C	M	58.91	825		C	CO	367 62.42
2903	63.12	C	M	61.53	225		C	VC	96 39.39
2904	62.35	C	M	58.89	1000	675	E	-228	18.22
2904	62.35	C	M	58.89	1000	675	E		23.83
2905		C	J		1000	675	E		21.39
2906		C	Q	58.58	1100	675	E	455	77.37
2907		C	Q	58.97	750		C	CO	-239 16.71
3501	59.32	C	M		1275		C		10.36
3502	60.39	C	M	59.34	150		C	VC	137 24.65
3503	59.46	C	M	58.31	150		C	ST	155 10.82
3504		C	J		1275		C	ST	11.65
3505		C	V	57.37	1500		C	ST	37.94
3505		C	V		825		C	ST	59.95
3506	59.47	C	M		1500		ST		5.05
3507		C	G		1500		ST		5.73
3508	59.01	C	M	57.99	375		C	CO	11.38
3509		F	Q		1275		C		30.4
3510		C	Q	59.16	150		C	ST	148 26.59
3511		F	Q		1275		C	CO	11.57
3601	60.07	C	M		1275		C	CO	26.19
3602	62.86	C	M	57.86	750		C	CO	38.97
3603		C	M						
3604		C	J		750		C	CO	61.01
3701	63.04	C	M	60.65	225		C	VC	156 84.49
3702	62.69	C	M	60.1	225		C	VC	37.74
3801	62.05	C	M	58.54	750		C	CO	642 121.99
3802	62.08	C	M						
3803	62.89	C	M	61.19	150		C	VC	43 21.07
3901	62.86	C	M	61.07	300		C	VC	256 53.8
3902	61.73	S	M	61.14	225		C	VC	369 40.57
3903	61.8	C	M		225		C	VC	40.22
3904	61.92	C	M	60.75	225		C	VC	23.7
3905	61.96	S	M	61.3	225		C	VC	159 22.32
3906		C	Q	58.74	750		C	CO	343 61.74
4500	63.4	C	M	62.1	150		C	VC	29 80.83
4601	59.83	C	M	57.85	1275		C	CO	33.05
4701	62.81	C	M	58.34	750		C	CO	76.29
4704	62.52	C	M		750		C	CO	33.55
4801	63.19	C	M	61.71	225		C	VC	64 89.09
4802	63.22	S	M	61.71	225		C	VC	132 87.27
4803	62.31	S	D	61.58	225		C	VC	217 52.05
4804	62.3	F	D	61.16	225		C	VC	143 51.61

NODE TABLE ABBREVIATIONS

MANHOLE FUNCTION

- F Foul

S Surface

C Combined
- T Transition

O Overflow

U Unspecified

MANHOLE / NODE TYPE

- M Manhole

J Junction

L Lamphole

H Hatchbox

R Rodding Eye

F Outfall

V Combined Sewer Overflow

P Pumping Station

S Soakaway

D Dual Function Manhole

W Treatment Works
- Z Ghost in Rising Main

C Cascade

Y Gully

E Ejector

O Oil Injector

I Inlet

B Hydrobrake

T Vent Column

X Valve

U Unspecified

Q Expendiency Node

G Ghost

(to allow pipe bends)

SEWER SHAPE

- C Circular

E Egg

O Oval

F Flat Top

R Rectangular

S Square
- T Trapezoidal

A Arch

B Barrel

H Horseshoe

U Unspecified

SEWER MATERIAL

- AC Asbestos Cement

BR Brick

CI Cast Iron

SI Spun (Grey) Iron

CO Concrete

CS Concrete Segments (Bolted)

CS Concrete Segments (Unbolted)

CC Concrete Box Culvert

DI Ductile Iron

GR Glass Reinforced Concrete

GR Glass Reinforced Plastic

PS Plastic / Steel Composite

PV Polyvinyl Chloride

PE Polyethylene

RP Reinforced Plastic Matrix

ST Steel

VC Vitrified Clay (All Clayware)

PP Polypropylene

PF Pitch Fibre

MA Masonry - In Regular Courses

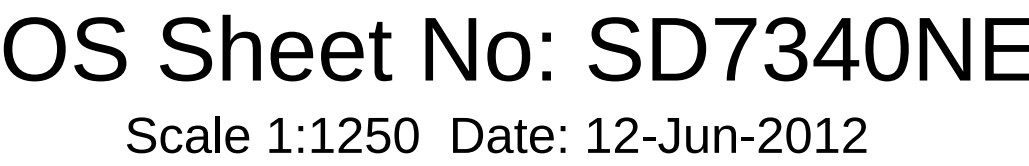
MA Masonry - Randomly Coursed

U Unspecified

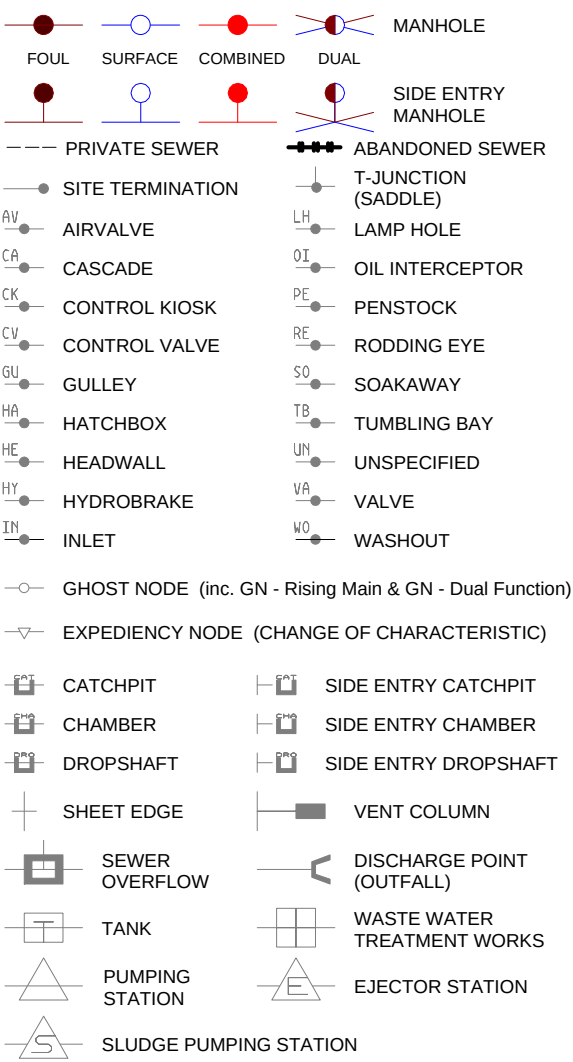
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Scale 1:1250 Date: 12-Jun-2012
47 Nodes
Sheet 1 of 1





WASTE WATER SYMBOLOGY



Note - ALL flow direction arrows are BLUE - colour not significant

NODE TABLE ABBREVIATIONS

MANHOLE FUNCTION

F Foul	T Transition
S Surface	O Overflow
C Combined	U Unspecified

MANHOLE / NODE TYPE

M	Manhole	Z	Ghost in Rising Main
J	Junction	C	Cascade
L	Lampbox	Y	Gulley
H	Hatchbox	E	Ejector
R	Rodding Eye	O	Oil Injector
F	Outfall	I	Inlet
V	Combined Sewer Overflow	B	Hydrobrake
P	Pumping Station	T	Vent Column
S	Soakaway	X	Valve
D	Dual Function Manhole	U	Unspecified
W	Treatment Works	Q	Expendity Node
		G	Ghost (to allow pipe bends)

SEWER SHAPE

C Circular	T Trapezoidal
E Egg	A Arch
O Oval	B Barrel
F Flat Top	H Horseshoe
R Rectangular	U Unspecified
S Square	

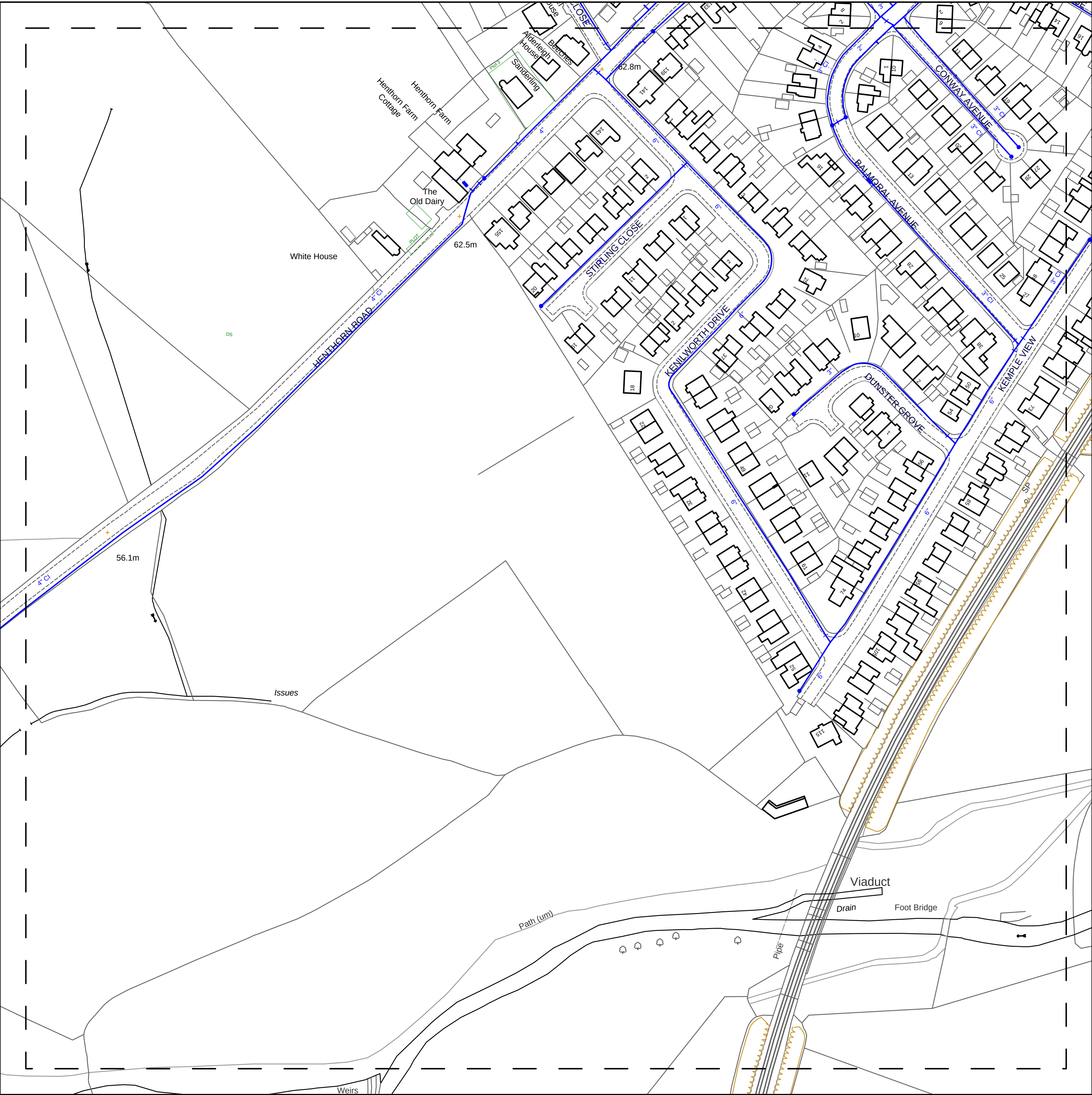
SEWER MATERIAL

AC Asbestos Cement
BR Brick
CI Cast Iron
SI Spun (Grey) Iron
CO Concrete
CS Concrete Segments (Bolted)
CS Concrete Segments (Unbolted)
CC Concrete Box Culvert
DI Ductile Iron
GR Glass Reinforced Concrete
GR Glass Reinforced Plastic
PS Plastic / Steel Composite
PV Polyvinyl Chloride
PE Polyethylene
RP Reinforced Plastic Matrix
ST Steel
VC Vitrified Clay (All Clayware)
PP Polypropylene
PF Pitch Fibre
MA Masonry - In Regular Courses
MA Masonry - Randomly Coursed
U Unspecified

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20 Nodes
Sheet 1 of 1





OS Sheet No: SD7340NW
Scale 1:1250 Date: 12-Jun-2012

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S1

L1

S2

L2

S3

L2

S4

L2

M1

M2

M3

M4

LEGEND

TRUNK MAIN

DISTRICT MAIN

NON-POTABLE MAIN

PROPOSED

AQUEDUCT

COMMON PIPE

PRIVATE PIPE

ABANDONED

NODES / FURNITURE

END CAP

CLOCKWISE VALVE

ANTI-CLOCKWISE VALVE

SHEET EDGE

AIR VALVE

TREATED WATER

SLUCE VALVE

PRESSURE

SUSTAINING VALVE

REDUCING VALVE

REFLUX VALVE

CHANGE OF CHARACTERISTIC

ANODE

CHLORINATION POINT

DE-CHLORINATION POINT

BORE HOLE

ABSTRACTION POINT

INLET POINT

BULK SUPPLY POINT

NW WASHOUT

FIRE HYDRANT

SHARED HYDRANT

PUMP

SITE TERMINATION

INTERMEDIATE NODE

CONCESSION START

CONCESSION END

METER

METER AND STOPTAP

STOPTAP

MONITOR LOCATION

SP

AP

HB

IP

RM

SPT

LB

STRAIN POINT

ACCESS POINT

HATCHBOX

INSERT

PROBE POINT

ROUTE MARKER

SAMPLING POINT

LOGGER BOX

PROPERTY TYPES

CONDITION REPORT

PB

PT

TELEMETRY STATION

PUMPING STATION

PUMP HOUSE

WATER TREATMENT WORKS

PRIVATE TREATMENT WORKS

VH

VALVE HOUSE

WATER TOWER

CS

DU

SR

SUP RES

CONFINED SPACE

DIALYSIS UNIT

SERVICE RESERVOIR

SUPPLY RESERVOIR

MATERIAL TYPES

AC

CI

CU

CO

DI

GI

GR

ASBESTOS CEMENT

CAST IRON

COPPER

CONCRETE

DUCTILE IRON

GALVANISED IRON

GREY IRON

OT

PB

PV

SI

ST

UN

PE

OTHERS

LEAD

uPVC

SPUN IRON

STEEL

UNKNOWN

POLYETHYLENE

LINING TYPES

CL

TB

CEMENT

TAR OR BITUMEN

ER

EPOXY RESIN

INSERTION TYPES

DD

MO

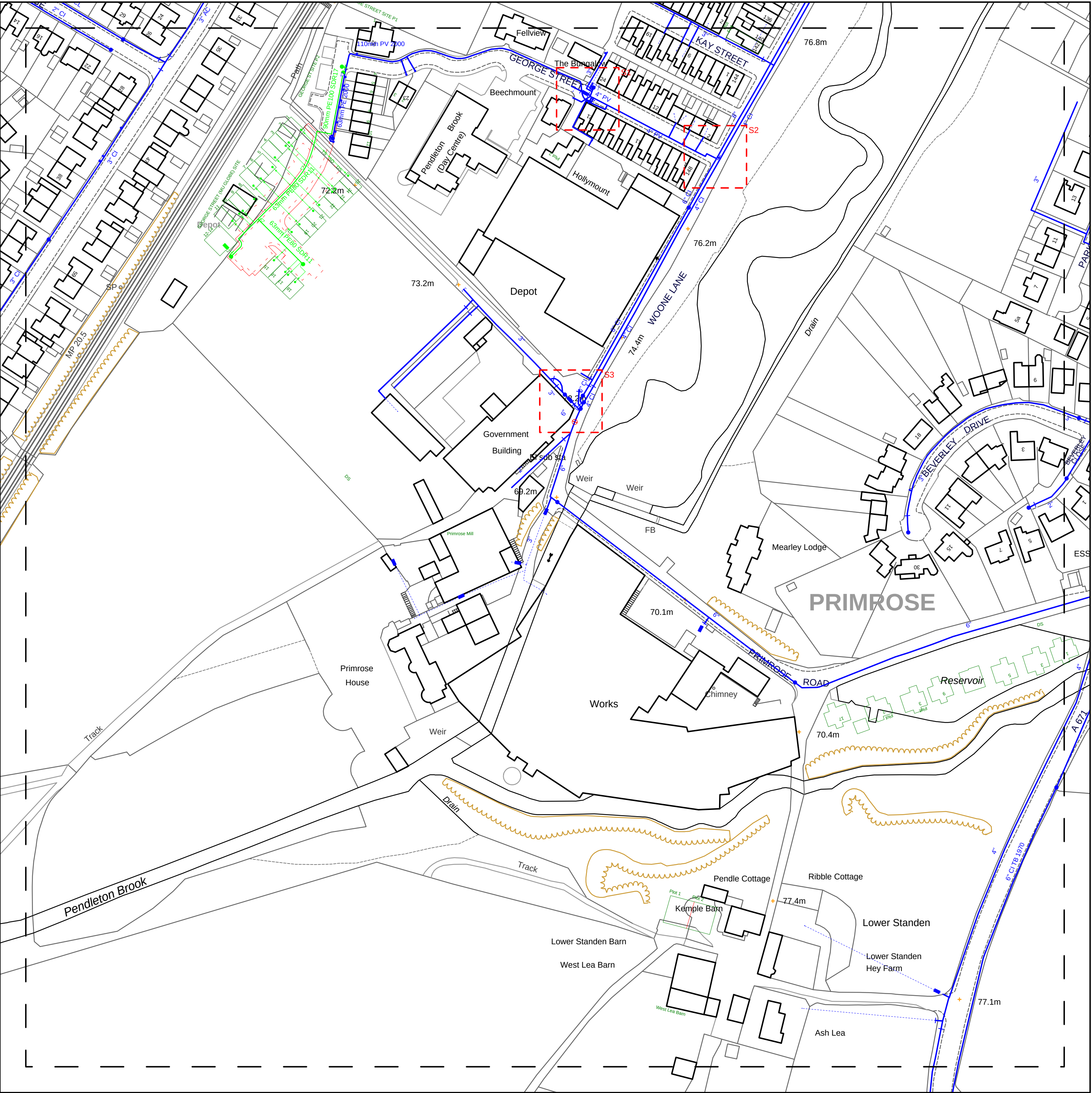
DIE DRAWN

MOLING

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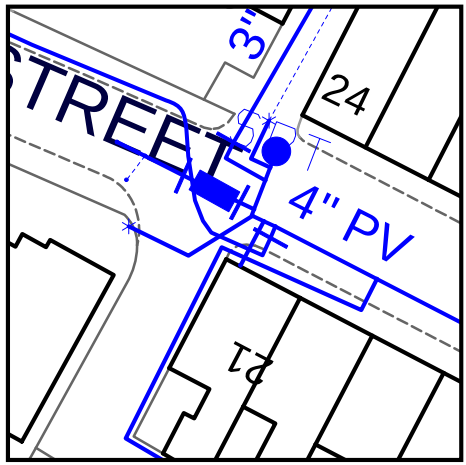
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Date: 12-Jun-2012



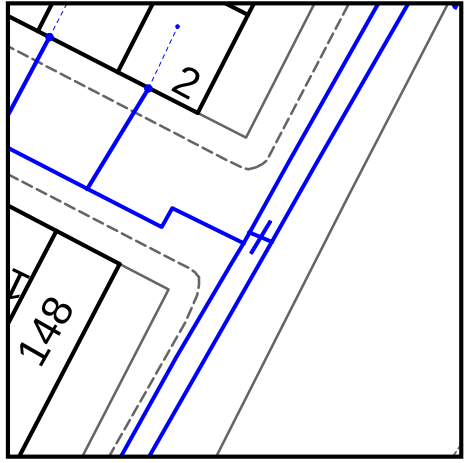


OS Sheet No: SD7340NE
Scale 1:1250 Date: 12-Jun-2012

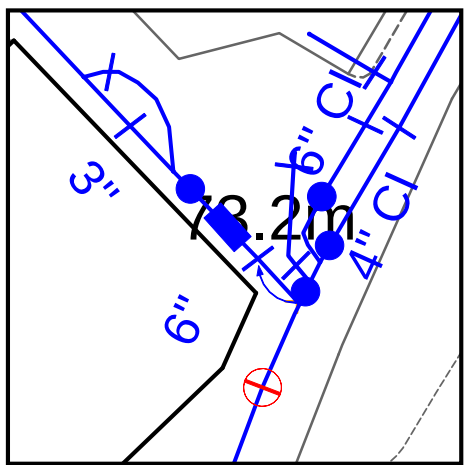
Printed by: Angela Gall



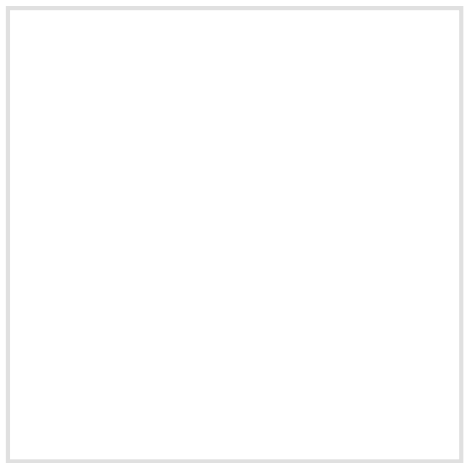
S1



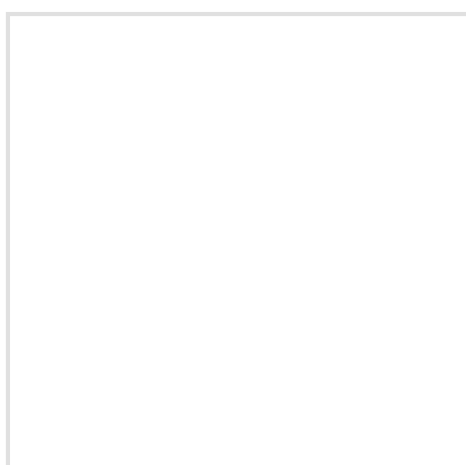
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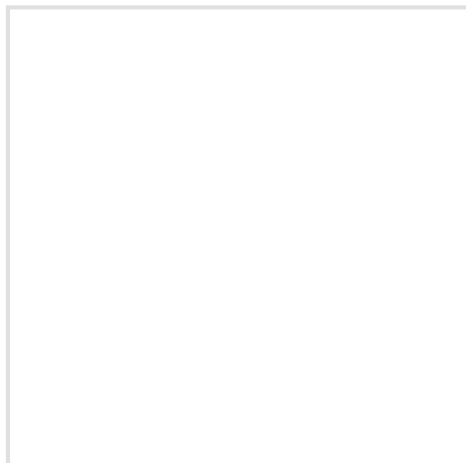
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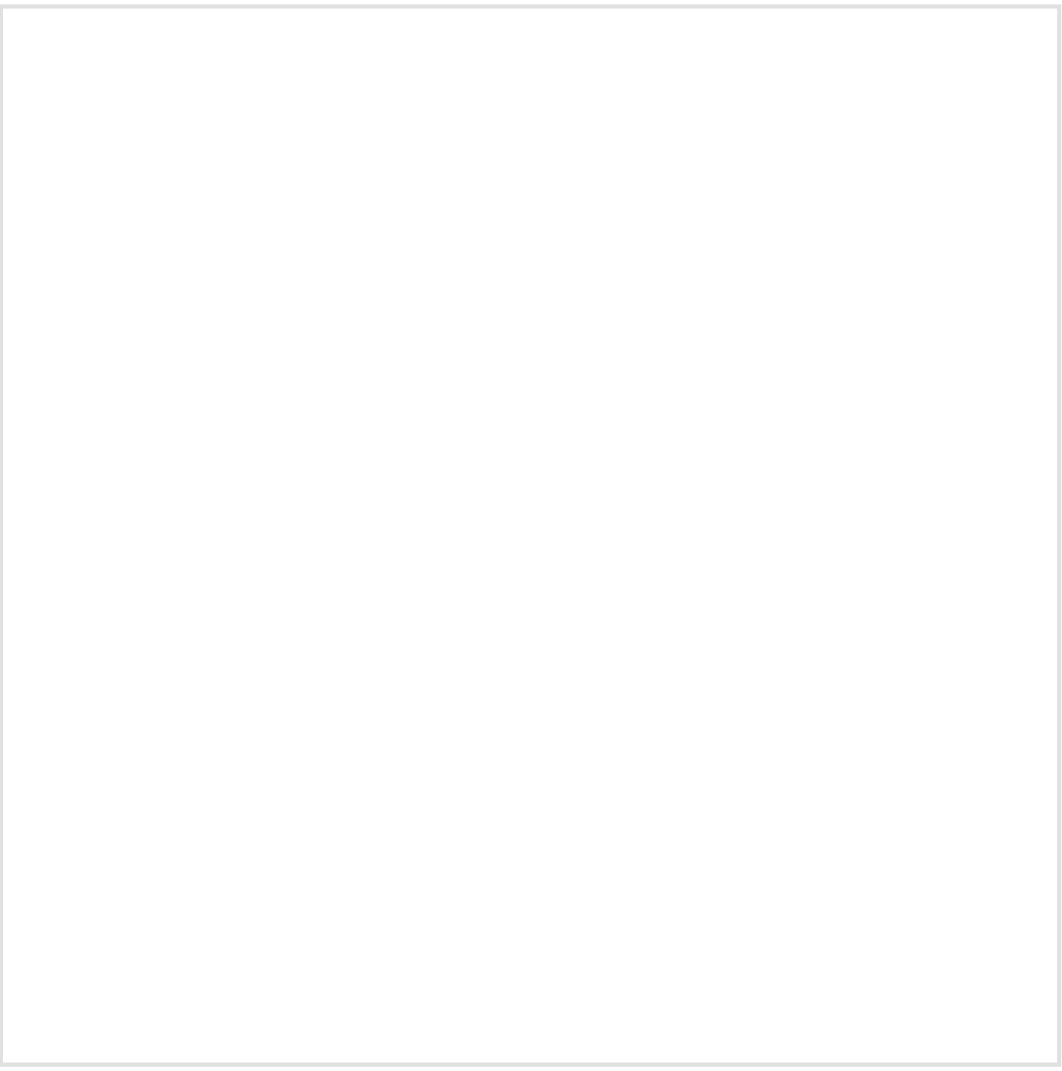
S4



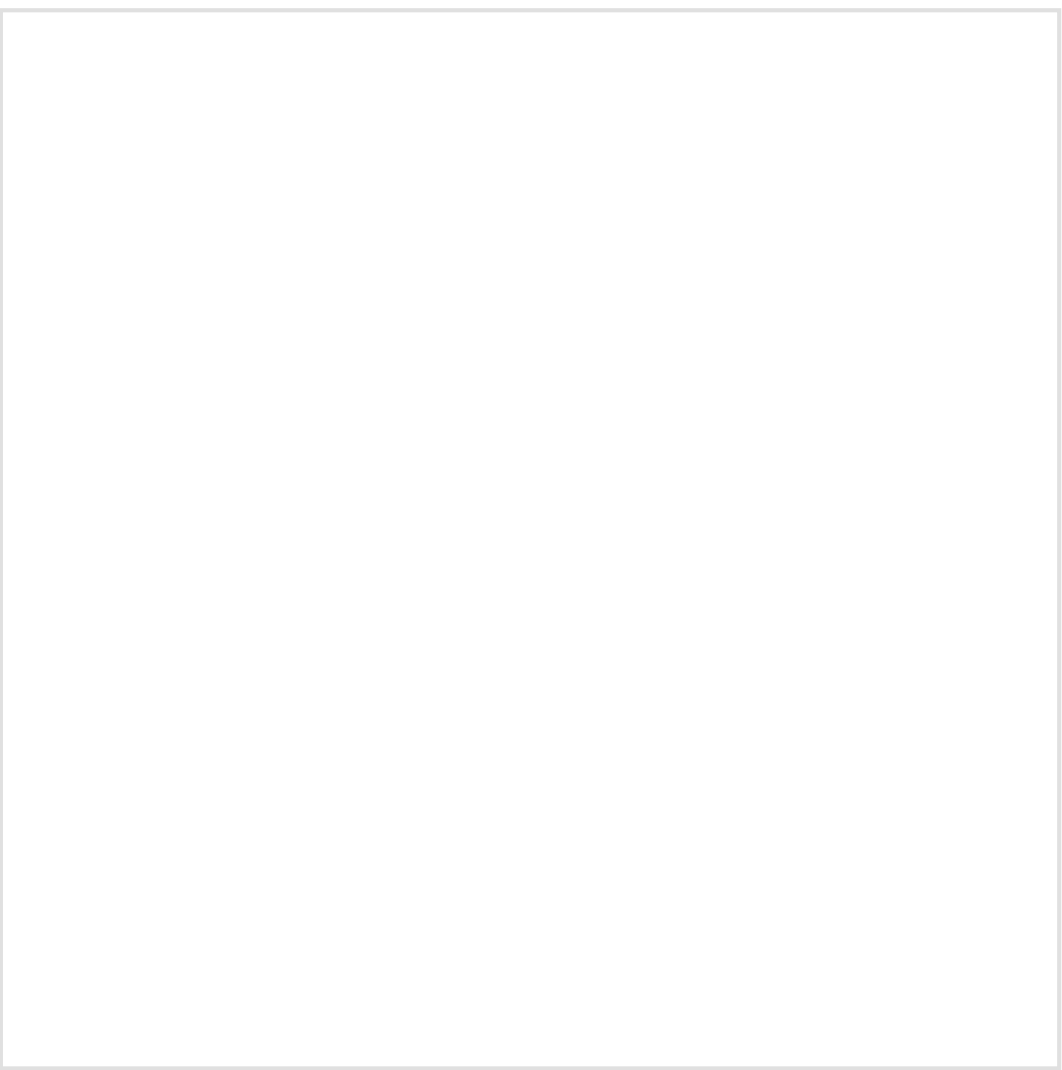
M1



M3



L1



L2



M2



M4

- LEGEND
- | | |
|------------------|--------------|
| TRUNK MAIN | AQUEDUCT |
| DISTRICT MAIN | COMMON PIPE |
| NON-POTABLE MAIN | PRIVATE PIPE |
| PROPOSED | ABANDONED |

- NODES / FURNITURE
- | | | | |
|--------------------------|---------------------------|---------------------------|-------------------------|
| END CAP | CLOCKWISE VALVE | ANTI-CLOCKWISE VALVE | SHEET EDGE |
| AIR VALVE | TREATED WATER SLUCE VALVE | PRESSURE SUSTAINING VALVE | PRESSURE REDUCING VALVE |
| CHANGE OF CHARACTERISTIC | ANODE | CHLORINATION POINT | DE-CHLORINATION POINT |
| BORE HOLE | ABSTRACTION POINT | INLET POINT | BULK SUPPLY POINT |
| NW WASHOUT | FIRE HYDRANT | SHARED HYDRANT | PUMP |
| SITE TERMINATION | INTERMEDIATE NODE | CONCESSION START | CONCESSION END |
| METER | METER AND STOPTAP | STOPTAP | MONITOR LOCATION |
| SP STRAIN POINT | AP ACCESS POINT | HB HATCHBOX | IP INSERT PROBE POINT |
| RM ROUTE MARKER | SPT SAMPLING POINT | LB LOGGER BOX | |

- PROPERTY TYPES
- | | | |
|-----------------------|-------------------------|--------------------------|
| CONDITION REPORT | PB PIPE BRIDGE | PT PIPE TUNNEL |
| T5 TELEMETRY STATION | PUMPING STATION | PUMP HOUSE |
| WATER TREATMENT WORKS | PRIVATE TREATMENT WORKS | VH VALVE HOUSE |
| CS CONFINED SPACE | DU DIALYSIS UNIT | SR SERVICE RESERVOIR |
| | | SUP RES SUPPLY RESERVOIR |

- MATERIAL TYPES
- | | |
|--------------------|-----------------|
| AC ASBESTOS CEMENT | OT OTHERS |
| CI CAST IRON | PB LEAD |
| CU COPPER | PV uPVC |
| CO CONCRETE | SI SPUN IRON |
| DI DUCTILE IRON | ST STEEL |
| GI GALVANISED IRON | UN UNKNOWN |
| GR GREY IRON | PE POLYETHYLENE |

- LINING TYPES
- | | |
|-------------------|----------------|
| CL CEMENT | ER EPOXY RESIN |
| TB TAR OR BITUMEN | |

- INSERTION TYPES
- | | |
|--------------|-----------|
| DD DIE DRAWN | MO MOLING |
|--------------|-----------|

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OS Sheet No: SD7340NE
Scale 1:1250
Date: 12-Jun-2012



APPENDIX E

GREENFIELD RUNOFF CALCULATIONS

RSK LDE Ltd		Page 1																								
18 Frogmore Road Hemel Hempstead Herts, HP3 9RT	Pre-development Henthorn Road Clitheroe																									
Date May 2012 File	Designed By CW Checked By																									
Elstree Computing Ltd	Source Control W.12.5																									
<u>ICP SUDS Mean Annual Flood</u> Input <table> <tr> <td>Return Period (years)</td> <td>100</td> <td>Soil</td> <td>0.450</td> </tr> <tr> <td>Area (ha)</td> <td>4.977</td> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SAAR (mm)</td> <td>1134</td> <td>Region Number</td> <td>Region 10</td> </tr> </table> Results l/s <table> <tr> <td>QBAR Rural</td> <td>38.4</td> </tr> <tr> <td>QBAR Urban</td> <td>38.4</td> </tr> <tr> <td>Q100 years</td> <td>80.0</td> </tr> <tr> <td>Q1 year</td> <td>33.4</td> </tr> <tr> <td>Q30 years</td> <td>65.2</td> </tr> <tr> <td>Q100 years</td> <td>80.0</td> </tr> </table>			Return Period (years)	100	Soil	0.450	Area (ha)	4.977	Urban	0.000	SAAR (mm)	1134	Region Number	Region 10	QBAR Rural	38.4	QBAR Urban	38.4	Q100 years	80.0	Q1 year	33.4	Q30 years	65.2	Q100 years	80.0
Return Period (years)	100	Soil	0.450																							
Area (ha)	4.977	Urban	0.000																							
SAAR (mm)	1134	Region Number	Region 10																							
QBAR Rural	38.4																									
QBAR Urban	38.4																									
Q100 years	80.0																									
Q1 year	33.4																									
Q30 years	65.2																									
Q100 years	80.0																									
©1982-2010 Micro Drainage Ltd																										



APPENDIX F ATTENUATION VOLUME CALCULATION SHEET

RSK LDE Ltd		Page 1			
18 Frogmore Road Hemel Hempstead Herts, HP3 9RT	Henthorn Road Attenuation Volume Q100CC				
Date June 12 File Q100CC.srcx	Designed By CW Checked By				
Elstree Computing Ltd	Source Control W.12.5				
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	54.294	0.794	80.0	368.6	O K
30 min Summer	54.498	0.998	80.0	531.9	O K
60 min Summer	54.658	1.158	80.0	678.5	O K
120 min Summer	54.720	1.220	80.0	740.4	Flood Risk
180 min Summer	54.712	1.212	80.0	732.2	Flood Risk
240 min Summer	54.698	1.198	80.0	717.6	O K
360 min Summer	54.653	1.153	80.0	673.4	O K
480 min Summer	54.592	1.092	80.0	615.6	O K
600 min Summer	54.527	1.027	80.0	557.4	O K
720 min Summer	54.457	0.957	80.0	497.0	O K
960 min Summer	54.308	0.808	80.0	379.5	O K
1440 min Summer	54.011	0.511	80.0	189.2	O K
2160 min Summer	53.628	0.128	80.0	31.1	O K
2880 min Summer	53.515	0.015	80.0	3.1	O K
4320 min Summer	53.501	0.001	60.0	2.5	O K
5760 min Summer	53.501	0.001	60.0	4.9	O K
7200 min Summer	53.501	0.001	60.0	4.7	O K
8640 min Summer	53.500	0.000	32.9	4.8	O K
10080 min Summer	53.500	0.000	29.6	4.9	O K
Storm Event	Rain (mm/hr)	Time-Peak (mins)			
15 min Summer	111.544	33			
30 min Summer	78.811	44			
60 min Summer	53.203	68			
120 min Summer	34.395	110			
180 min Summer	26.061	144			
240 min Summer	21.387	178			
360 min Summer	16.129	246			
480 min Summer	13.172	314			
600 min Summer	11.242	382			
720 min Summer	9.869	446			
960 min Summer	8.023	572			
1440 min Summer	5.974	806			
2160 min Summer	4.432	1132			
2880 min Summer	3.592	1464			
4320 min Summer	2.672	2344			
5760 min Summer	2.169	2976			
7200 min Summer	1.848	3152			
8640 min Summer	1.624	3896			
10080 min Summer	1.457	5248			
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RSK LDE Ltd		Page 2			
18 Frogmore Road Hemel Hempstead Herts, HP3 9RT	Henthorn Road Attenuation Volume Q100CC				
Date June 12 File Q100CC.srcx	Designed By CW Checked By				
Elstree Computing Ltd Source Control W.12.5					
Summary of Results for 100 year Return Period (+30%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	54.371	0.871	80.0	427.0	O K
30 min Winter	54.592	1.092	80.0	616.0	O K
60 min Winter	54.771	1.271	80.0	792.4	Flood Risk
120 min Winter	54.856	1.356	80.0	884.4	Flood Risk
180 min Winter	54.839	1.339	80.0	865.5	Flood Risk
240 min Winter	54.815	1.315	80.0	839.2	Flood Risk
360 min Winter	54.739	1.239	80.0	759.9	Flood Risk
480 min Winter	54.643	1.143	80.0	664.4	O K
600 min Winter	54.535	1.035	80.0	564.0	O K
720 min Winter	54.418	0.918	80.0	464.7	O K
960 min Winter	54.173	0.673	80.0	285.5	O K
1440 min Winter	53.651	0.151	80.0	37.9	O K
2160 min Winter	53.503	0.003	80.0	2.5	O K
2880 min Winter	53.501	0.001	80.0	2.5	O K
4320 min Winter	53.501	0.001	60.0	2.5	O K
5760 min Winter	53.500	0.000	31.8	4.9	O K
7200 min Winter	53.500	0.000	27.1	4.9	O K
8640 min Winter	53.500	0.000	23.8	4.9	O K
10080 min Winter	53.500	0.000	21.4	4.9	O K
Storm Event		Rain (mm/hr)		Time-Peak (mins)	
15 min Winter		111.544		34	
30 min Winter		78.811		45	
60 min Winter		53.203		68	
120 min Winter		34.395		118	
180 min Winter		26.061		154	
240 min Winter		21.387		192	
360 min Winter		16.129		268	
480 min Winter		13.172		340	
600 min Winter		11.242		410	
720 min Winter		9.869		476	
960 min Winter		8.023		598	
1440 min Winter		5.974		798	
2160 min Winter		4.432		836	
2880 min Winter		3.592		1704	
4320 min Winter		2.672		2804	
5760 min Winter		2.169		3296	
7200 min Winter		1.848		3696	
8640 min Winter		1.624		3984	
10080 min Winter		1.457		5080	
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RSK LDE Ltd		Page 3
18 Frogmore Road Hemel Hempstead Herts, HP3 9RT	Henthorn Road Attenuation Volume Q100CC	
Date June 12 File Q100CC.srcx	Designed By CW Checked By	
Elstree Computing Ltd	Source Control W.12.5	

Model Details

Storage is Online Cover Level (m) 55.000

Tank or Pond Structure

Invert Level (m) 53.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	200.0	1.500	1200.0

Depth/Flow Relationship Outflow Control

Invert Level (m) 53.500

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	80.0000	1.500	80.0000