

Foul and Surface Water Drainage Concept

**Proposed Residential Development
Land at Preston Road
Longridge
Preston**

**REC Report: 44661 - 1r0
Issued: December 2012**

Prepared for

miller homes

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QUALITY ASSURANCE

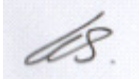
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(Located on CD attached to rear of Report)

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Drawing 44661p1-003	Proposed Site Layout
Drawing 44661p1-004	Drainage Concept Plan
Drawing 44661p1-005	Exploratory Hole Location Plan

EXECUTIVE SUMMARY

Site Area	2.40ha
Existing / Historic Use	Greenfield
Proposed Use	Residential
Existing Impermeable Area	0.0ha
Proposed Impermeable Area	1.34ha
Average Runoff Coefficient (Existing)	0.35
Average Runoff Coefficient (Proposed)	0.67
Calculated existing surface water discharge rate	$Q_{BAR} = 19.55 \text{ l/s}$ $Q_2 = 18.59 \text{ l/s}$ $Q_{30} = 31.91 \text{ l/s}$ $Q_{100} = 37.85 \text{ l/s}$
Proposed discharge rate	As above – to be agreed with EA / UU
Proposed improvement to discharge rate	0%
Proposed Surface Water Storage	Up to 530m ³ below ground storage Up to 270m ³ above ground storage – floodable areas
Infiltration Potential?	No – Clay soils
Proposed receptor for surface water discharges	Surface watercourse located to west of site – via existing public sewer outfall / new connection subject to EA Discharge Consent
Proposed discharge control	Orifices fitted to individual storage areas Discharge – minimal fall across site .with freely draining gravity outfall solution.
Climate Change Allowance	30%

1.0 INTRODUCTION

1.1 Background

Resource and Environmental Consultants Ltd (REC) has been commissioned by Miller Homes to prepare a Foul and Surface Water Drainage Concept for a proposed residential development located off Preston Road, Longridge, Preston.

The requirements of the National Planning Policy Framework (2012), the National Standards for Sustainable Drainage Systems (2011), Sewers for Adoption (2012) and the SuDS Manual have been considered within this study.

This report is to inform the design layout for the site and constitutes neither a formal Flood Risk Assessment nor a detailed Foul and Surface Water Management Plan. It has been prepared considering the findings of a Drainage Strategy Report produced for the site in September 2012¹.

1.2 Site Details

Site Address	Preston Road, Longridge, Preston, PR3 3AR
National Grid Reference	E360061, N436070
Site Area	2.40 ha

Table 001: Site Setting

1.3 Current Layout

The site is currently comprised of undeveloped greenfield land with a total area of 2.40ha. The Existing Site Layout is presented as Drawing 44661p1-002, provided on the CD attached to the rear of this report.

1.4 Proposed Development

The proposed scheme includes the construction of approximately 58 new residential dwellings with associated access roads, car parking and gardens.

The form and layout of the scheme assessed is located at Drawing 44661p1-003 – Proposed Development Plan and is provided on the CD attached to the rear of this report.

1.5 Objectives

The objectives of this Drainage Concept Report are to:

- Review the development proposals and topographical survey for the site;
- Review the original Drainage Strategy Report produced for the site (Sept. 2012) produced by PSA;
- Investigate the existing greenfield surface water runoff rates at the site;
- Verify the surface water runoff volumes outlined for the site by the Drainage Strategy Report, using Windes Microdrainage, including consideration of climate change;

¹ PSA Design (Sept. 2012). Drainage Strategy: Proposed Residential Development, Preston Road, Longridge.

- Prepare a Drainage Concept Plan in graphical format, indicating the location and nature of proposed surface water storage features to mitigate surface water flooding; and
- Prepare a brief report outlining the assumptions and calculations made within the preparation of the Drainage Concept Plan.

1.6 Limitations

The limitations of this report are presented in Appendix IV.

1.7 Confidentiality

REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.

2.0 SOURCES OF INFORMATION

2.1 General

In preparing this assessment background information has been sought from the following sources:

- Drainage Strategy Report (September 2012);
- United Utilities Correspondence September 2012 (Graham Perry);
- Water UK (2012). Sewers for Adoption 7th Edition;
- CIRIA (2007). C696: The SUDS Manual.
- Defra (2012). National Standards for Sustainable Drainage Systems.
- Communities and Local Government (March 2012). National Planning Policy Framework.
- CEH Wallingford (2009). Flood Estimation Handbook CD ROM: Version 3; and
- Site specific topographical survey;
- British Geological Survey - Geological Mapping²; and
- Site Investigation Data (REC Ltd 2012).

2.2 United Utilities

United Utilities was contacted in September 2012 to establish its requirements for the management of surface water runoff at the site as part of the original Drainage Strategy Report. The following point was noted with regards the surface water drainage constraints at the site:

'I...would suggest that the most feasible option would be to drainage surface water directly to the watercourse to the east or into MH 7000 which is part of a dedicated surface water system. Either way surface water will have to be restricted to Greenfield runoff rates based on IOH 124, which I assume would be around 10-15 l/s.'

Based on this consultation UU has indicated that it would be prepared to accept surface water discharges from the site into its surface water sewer network. This would be subject to the submission of further detailed information relating to the design of the Surface Water Management Systems at the site.

2.3 Topographical Survey

Topographical survey for the site shows land levels to range between 86m AOD to 83.5m AOD, being highest in the north of the site and reducing in a generally south and westerly direction. The maximum drainage path for surface water runoff is approximately 250m in length.

Levels at the proposed outfall location to the drainage ditch located to the west of the site are located at between 78.14m AOD and 79.00m AOD.

The Topographical Survey is presented as Drawing 44661p1-002 and is provided on the CD attached to the rear of this report.

² <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

2.4 Geological Mapping

Geological mapping for the site has been downloaded from the British Geological Survey website. This indicates the geology beneath the site to comprise Warley Wise Grit - Sandstone. Sedimentary Bedrock formed approximately 325 to 327 million years ago in the Carboniferous Period. Local environment previously dominated by rivers.

These rocks were formed from rivers depositing mainly sand and gravel detrital material in channels to form river terrace deposits, with fine silt and clay from overbank floods forming floodplain alluvium, and some bogs depositing peat; includes estuarine and coastal plain deposits mapped as alluvium.

2.5 Site Investigation

Intrusive site investigation has been undertaken and groundwater was found to be located >5m below ground level throughout the site. In light of this it is assumed that infiltration is not possible due to the presence of clay beneath the site. See REC site investigation ref 44661 dated Nov 2012.

2.6 Hydrological Review

The site is located east of a small drainage channel. This watercourse flows in a generally southerly direction in the vicinity of the site. The standard percentage runoff associated with the catchment is 38.8% indicating a moderately impermeable geology.

Information downloaded from the Environment Agency website indicates the site to be located in Flood Zone 1 (Low Risk) and to be unaffected by groundwater Source Protection Zones or reservoir flood zones.

No further surface water features are located within the vicinity of the site.

2.7 Hydrogeological Review

Hydrogeological mapping for the site has been downloaded from the British Geological Survey website³. This indicates the hydrogeology beneath the site to be comprised of the Millstone Grit Group *'Moderately productive aquifer. Regionally significant multi-layered aquifer up to 900 m thick with yields of 5-10 l/s, rarely 50 l/s, with many springs.'*

³ <http://mapapps.bgs.ac.uk/hydrogeologymap/hydromap.html>

3.0 DRAINAGE CONCEPT

3.1 Introduction

This Drainage Concept Plan considers the existing rates and volumes of surface water runoff from the site and seeks to recommend surface water attenuation and controlled discharge in order to ensure that these are maintained, with no consequent increase in flood risk at the site or to third party land, now and in the future.

This assessment has been completed with due regard to the principals of the NPPF and using the current 'industry best practice' guidance as outlined in the SUDS Manual⁴ and National Standards for Sustainable Drainage Systems. The findings of the original Drainage Strategy Report have also been considered within this study.

3.2 Land Use

Table 002 summarises the changes in land use and runoff coefficients for surface water at the site.

Surface Finishing	Existing Site	Proposed Site
Built + hardstanding	0.00ha	1.34ha
Soft Landscaping	2.40ha	1.05ha
Runoff Coefficient	0.35	0.67

Table 002: Summary of Land Use

3.3 Constraints to the Use of SuDS

Site investigation indicates the geology beneath the site to comprise impervious clays, which yield low rates of infiltration and preclude the use of infiltration as the primary method of surface water disposal from the site.

It is however possible to discharge surface water runoff from the site at controlled rates to the drainage channel to the west of the site, which currently likely accepts surface water discharges from the site via overland flowpaths at greenfield rates. A United Utilities Surface Water Sewer outfall is located on this watercourse in the vicinity of the application site.

3.4 Options for Surface Water Disposal

As an overview Surface Water will be discharged to the SW corner of the site and the Foul to discharge to the NW corner of the site – see proposed drainage plan. The use of infiltration methods for the disposal of surface water from the site has been precluded owing to the predominance of underlying clay soils. It is therefore proposed to discharge surface water runoff from the site into the Drainage Channel some 240m to the western boundary of the application site.

There is an existing watercourse into which it will be possible to establish a connection and which UU has intimated would be acceptable, although the rate(s) of discharge would be subject to further detailed consideration.

⁴ CIRIA (2007). C697 The SUDS Manual.

REC has calculated the minimum distance of 250-350m to the outfall, requires an overall fall of 1:200. For the purposes of this assessment it has been assumed that surface water discharge rates could be reduced back to the existing 2 year greenfield rate..

It can be demonstrated that, although difficult to achieve, adequate fall can be provided within the sites drainage network for self-cleansing freely draining gravitational systems between the furthest drainage path and the surface water storage area.

The final discharge solution adopted at the site will be subject to ratification by the Lead Local Flood Authority, Preston City Council, the Environment Agency and United Utilities; the latter has indicated it would accept surface water discharges from the site.

3.5 Estimation of Greenfield Runoff Rates

Using catchment descriptor information downloaded from the Flood Estimation Handbook CD ROM V3 as input the WinDes Microdrainage software package (Institute of Hydrology Method 124) has been used to generate the greenfield runoff rates for the drainage catchment in which the site lies. The following parameters have been incorporated into these calculations:

- Catchment Area: 50ha linearly interpolated back to site area, measured using AutoCAD from the site survey as 2.40ha;
- Average Annual Rainfall (SAAR) land use data: 991mm/year;
- Soil: 0.45;
- URBEXT 0.151;
- Region No. 10.

In line with best practise runoff rates have been generated based on a 50ha catchment and linearly interpolated back to the site area. Table 003 summarises the greenfield runoff rates calculated at the site.

Return Period (Years)	Runoff Rate (l/s/ha)	Runoff Rate (l/s)
Q _{BAR}	8.19	19.55
2	7.79	18.59
30	13.37	31.91
100	37.85	37.85

Table 003: Summary of Greenfield Runoff Rates

These rates of runoff are slightly lower than those calculated within the September 2012 Drainage Strategy Report. This is thought to be for the following reasons:

- The Drainage Strategy Report utilised FSR rainfall, whereas rainfall data were downloaded from the FEH CD ROM Version 3 for this study.
- The catchment area used in IOH 124 was not linearly interpolated back from a 50ha catchment.

However, an overall correlation is seen between the runoff rates calculated at the site, which are within an acceptable degree of error from each other, with no consequent further action required.

3.6 Surface Water Attenuation Requirements

Using the calculated allowable discharge rates for a 2 year storm (outlined above) and land use data as inputs, the WinDes Micro Drainage software suite has been used to estimate the surface water attenuation requirements at the site in order to limit site discharges to greenfield rates. Storm scenarios were run for both winter and summer profiles for the Q30 and Q100 events, for a range of durations between 15-1440 minutes, with the following design inputs:

- Tank / Pond Storage
- Gravity Discharge
- FEH rainfall Data
- 30% climate change

Based on these calculations the following surface water storage requirements have been estimated for the site:

Return Period Rainfall Event (years)	Required Storage Volume (m ³)
Q30	530
Q100	800

Table 004: Summary of Surface Water Attenuation Requirements

The required storage volumes have increased from those originally designated within the Drainage Strategy Report. This is due to the following:

- FEH rainfall has been utilised instead of FSR;
- The storage option assessed is for a tank or pond rather than oversized pipes;
- Discharge rates have been limited to the 2 year storm.

3.7 Proposed Mitigation

It is proposed to provide a total maximum surface water storage volume of up to 800m³ within the site. This will be achieved using a combination of above and below ground storage, as outlined below.

It is proposed to provide surface water attenuation storage using a central surface water attenuation pond located in the centre of the southern section of the application site. This below ground storage has been sized to attenuate flows for return period events up to 30 years including climate change at 30% (530m³). All pipework will be sized to convey water to the storage area during a peak (15 min) intensity Q30 storm.

Surface water runoff for events between 30 and 100 years (270m³) will be attenuated using above ground floodable areas located within the car parks and roads within the site. Water will be retained within above ground floodable areas using a combination of surface contouring and kerbing.

Drawing 44661p1-004 summarises the conceptual layout for the surface water management system proposed for the site.

The attenuation outlined is calculated based on a worst case scenario involving restriction of greenfield discharges from the site back to the 2 year rate. This is to account for design constraints of using a gravity drainage solution and the potential requirements of the Environment Agency and United Utilities.

It is considered likely that this storage requirement will be subject to revision based on changes to the site Masterplan, detailed consultation with the Environment Agency / United Utilities, and the final detailed design of the sites Surface Water Management System.. In the event that a multiple discharge rate is feasible at the site (based on varying rates of discharge for smaller / greater return period rainfall events), it is likely that the storage requirements at the site will be reduced.

3.7.1 Groundwater Consideration

Site investigation undertaken at the site indicates groundwater levels to be located at >5m bgl. It is therefore considered unlikely that groundwater levels will impact on flood storage. However, it is recommended that the design of the storage area include further investigation into the exact groundwater levels in the vicinity of the proposed surface water storage area.

In the event that a low freeboard exists between the base of the storage area and groundwater it is recommended that the storage area be lined with clay to prevent the ingress of groundwater.

3.7.2 Discharge Control

The surface water storage area will be subject to gravity discharge solution. The allowable discharge will be set based on calculated greenfield rates and following discussion with the Environment Agency and or United Utilities, dependent on the final outfall solution adopted. The final rate of discharge may also depend on the design of the pumped system, i.e. whether a multiple discharge rate is utilised to account for varying rates of runoff associated with smaller / larger return period rainfall events.

3.7.3 Network Capacity

In line with best practice and industry guidance the piped networks located throughout the site will be designed to accept peak flows during a 30 year return period rainfall event.

All pipework upstream of the flood storage area will be sized to accept flows for a peak intensity Q30 storm without surface flooding. All pipework connecting storage areas and leading to the ultimate downstream discharge point will be sized to accommodate the combined discharge rates from the individual storage areas.

3.7.4 Land Raising

It is anticipated that any land raising material can be taken from the footings and storage areas dig out.

3.8 Water Quality

3.8.1 Water Quality Treatment

Surface water runoff will be conveyed to the storage areas via a piped drainage networks. In general roof runoff will be conveyed direct to the storage area with no treatment.

All hardstanding areas such as carports and car parking will be fitted with silt traps and or baffles to minimise the discharge of sediments to the storage area.

SuDS measures such as swales open water bodies and / or permeable paving will be included within the Surface Water Management system wherever possible to improve the quality of surface water discharges and maximise infiltration at source.

The use of permeable pavement within the car park areas is recommended to provide water treatment at source through adhesion, adsorption and biodegradation of oils and hydrocarbons and the filtering and deposition of silts. The layout of the hardstanding and built area within the site includes interspersed grass and soft landscaped areas between the properties and the car parking and road areas within the site. These will also serve as overland flow routes and filter strips, which will further promote water quality.

3.90 OUTLINE FOUL DRAINAGE STRATEGY

3.91 Foul Drainage Strategy

A foul drainage strategy will be prepared to:

-  confirm the principles of the waste water drainage from the site;
-  confirm appropriate boundaries for development; and,
-  enable the relevant technical approval bodies to agree to elements for preliminary design.

A pre-development enquiry was submitted to United Utilities for a scheme of 58 units. Foul drainage from the site will be via the Foul Pumping Station, to be located to the south of the site. See conceptual drainage layouts for proposed location.

The exact size and location of the foul pumping station, to be confirmed at the detailed design stage. It is expected an allowance will have to be made to accommodate United Utilities tankers

4.0 DISCUSSION AND CONCLUSIONS

This study presents a Surface Water Drainage Concept, which includes consideration of the individual drainage catchments within the site and specifies surface water attenuation and controlled discharge measures to ensure that existing greenfield rates of surface water runoff are not exceeded.

The greenfield runoff rates at the site have been assessed using the IOH 124 Methodology within the WinDes Microdrainage software package and are found to be consistent with those outlined within the original Drainage Strategy Report produced for the site in September 2012.

The use of infiltration for the disposal of surface water has been precluded by the low percolations rates in the geology underlying the site. However the use of SuDS measures, are suggested where possible

It is proposed to discharge surface water from the site to a drainage channel some 240m from the sites western boundary. The topography of the site and the low relief between the site and the ultimate discharge point mean that a pumped drainage solution is the only viable option for the discharge of surface water from the site, as originally outlined within the Drainage Strategy Report (September 2012).

A United Utilities surface water sewer outfall is located on this watercourse into which it may be possible to establish a connection. United Utilities has been contacted and agreed in principle to this, subject to detailed consideration of the findings and recommendations contained within this assessment and the production of a Surface Water Management Plan for the site. Alternatively it may be possible to establish a new connection to the watercourse under consent from the Environment Agency.

The exact allowable discharge rate adopted at the site will be dependent on the results of discussions with the statutory consultees and the final design of the pumped drainage solution to be used at the site.

It is duly presented that the provision of a formal Surface Water Management System, including attenuation storage and controlled discharge, at the site will suitably mitigate potential increases in surface water flood risk at the site or to third party land or property. Additional capacity has been designed within the surface water drainage system to account for climate change at 30% throughout the development lifetime⁵ as required by the National Planning Policy Framework.

The conceptual mitigation solutions noted within this report and its drawings / appendices have been prepared with reference to industry guidance and best practice. The findings of this report are for the purpose of informing the concept site design and should be revisited as part of a detailed Surface Water Management Plan at the detailed design stage.

This assessment has been prepared without formal consultation with United Utilities or the Environment Agency, and will be subject to detailed consideration and ratification by the EA, United Utilities and the Lead Local Flood Authority. It is recommended that further consultation with these stakeholders be undertaken ahead of detailed design and construction being commenced.

⁵ A development lifetime of 100 years has been assessed in line with the requirements of NPPF for residential developments.

APPENDIX I WORKINGS

APPENDIX II LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Ltd and the Client as indicated in Section 1.2.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. In addition to the above REC Ltd note that when investigating, or developing, potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and also with time. The absence of certain ground, ground gas, and contamination or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Due to the presence of existing buildings and structures access could not be obtained to all areas. Additional contamination may be identified following the removal of the buildings or hard standing.
7. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
8. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.
9. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
10. This report presents an interpretation of the information obtained. Whilst every effort is made in interpretative reporting to assess the soil conditions over the Site it should be noted that natural strata vary from point to point and that man made deposits are subject to an even greater diversity. Groundwater conditions are dependent on seasonal and other factors. Consequently there may be conditions present not revealed by this investigation.
11. REC can not be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by REC is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by REC in this connection without their explicit written agreement there to by REC.
12. Rather, this investigation has been undertaken to provide a preliminary characterisation of the existing sub-surface geotechnical characteristics and make up and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.
13. This investigation has been undertaken to reasonably characterise existing sub-surface conditions and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

**CD CONTAINING
TOPOGRAPHIC SURVEY (TO SCALE)
SITE LAYOUT PLAN (TO SCALE)**