NHS Property Services Limited and McDermott Developments Limited

Former Clitheroe Hospital,

Chatburn Road,

Clitheroe,

Lancashire

Flood Risk and Foul Drainage Assessment

May 2017

Flood Risk & Foul Drainage Assessment

REPORT CONTROL

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Flood Risk & Foul Drainage Assessment

Contents

APPENDICES

1 INTRODUCTION

1.1 PURPOSE OF THE REPORT

NHS Property Services Limited and McDermott Developments Limited have commissioned WYG Engineering Ltd to undertake a Flood Risk and Foul Drainage Assessment (FRDA) in respect of the proposed residential development on a 1.97 ha site at the site of the former Clitheroe Community Hospital, off Chatburn Road, Clitheroe, Lancashire. This report has been prepared to accompany the full planning application for the development.

1.2 PROPOSED DEVELOPMENT

The proposed development is to consist of 60 residential units comprising a mix of 2, 3, 4 and 5 bedroom units together with associated landscaping and infrastructure.

The application site is currently occupied by buildings associated with the former Clitheroe Community Hospital and its existing associated infrastructure, thus the site is regarded as a brownfield development.

The proposed development is classified as "More Vulnerable" in accordance with Table 2 of the PPG - Flood Risk & Coastal Change (PPG).

A copy of the Proposed Site Layout Plan is contained in Appendix A.

1.3 REQUIREMENT FOR FLOOD RISK ASSESSMENT

According to flood risk mapping provided by the EA, the site is located entirely within Flood Zone 1: i.e. land assessed as having an annual probability of river or sea flooding less than 1 in 1000 (<0.1% Annual Exceedance Probability (AEP)) in any one year. However, as the application site is in excess of one hectare, in accordance with the Planning Practice Guidelines (Flood Risk & Coastal Change) [1], a Flood Risk Assessment is required to support the outline planning application.

1.4 SCOPE OF THE FLOOD RISK ASSESMENT

The FRA will be undertaken in accordance with the guidelines of the Environment Agency Flood Risk Assessment (FRA) Guidance https://www.gov.uk/guidance/flood-risk-assessment-in-flood-zone-1-and-critical-drainage-areas

[1] NPPF Section 103 note 20

The FRA will assess the existing flood risk to the site and establish a management regime for surface water runoff from the site such that flood risk to adjoining areas is not exacerbated. If not managed properly, surface water runoff from the site could potentially lead to increases in flood risk to other areas or the development itself.

In line with the PPG, the FRA will also consider other potential sources of flood risk, such as sewers, overland flow routes, groundwater flooding, reservoir flooding, and minor watercourses not shown on EA flood map.

As the planning application is a full application then a detailed surface water drainage strategy will be included in which potential measures for draining surface water will be discussed, and this will have a specific focus on implementing Sustainable Drainage Systems (SUDs) strategies.

1.5 FOUL DRAINAGE ASSESSMENT

The Foul Drainage Assessment will review the existing foul water drainage systems within and adjacent to the development site and identify the peak flows from the proposed development. The assessment will also identify points of connection to the public sewer system via a pre development application to United Utilities in relation to the proposed peak foul flows from the development.

1.6 LIMITATIONS OF THIS REPORT

This report has been prepared by WYG Engineering on behalf of the NHS Property Services Limited and McDermott Developments Limited with the scope of the report as described in Section 1.2 above and the particular instructions and requirements. It is not intended for and should not be relied on by any third party and no responsibility is undertaken to any third party.

WYG Engineering accepts no duty or responsibility (including in negligence) to any party other than the NHS Property Services Limited and McDermott Developments Limited and disclaims all liability of any nature whatsoever to any such party in respect of this report.

2 SITE DESCRIPTION

2.1 EXISTING SITE

The application site is currently defined as a combination of greenfield and brownfield, and it covers an area of 1.97 ha and is located off Chatburn Road, Clitheroe, Lancashire, as shown in Figures 1 and 2 below. The postcode and grid reference of the site are BB7 1QJ and SD 75456 43013 respectively.

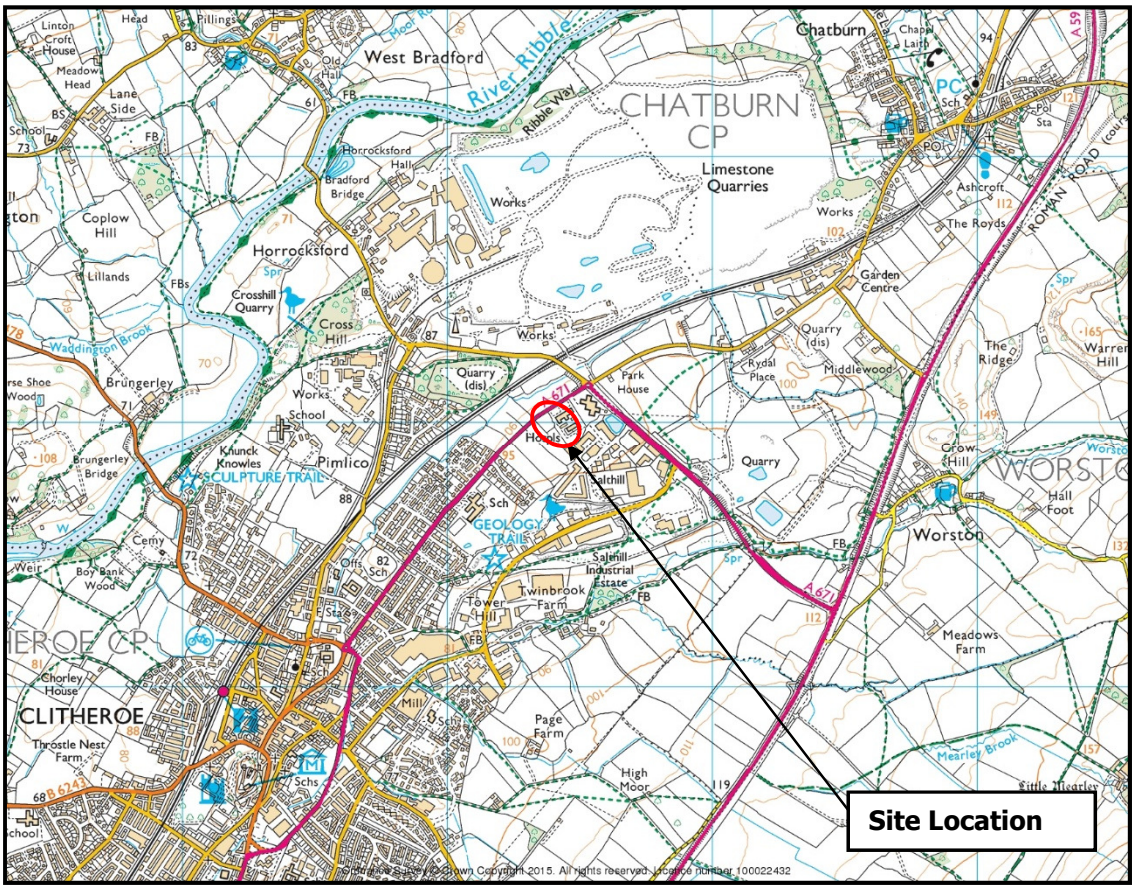


Figure 1 – Site Location[1]

The application site is located in the north eastern outskirts of Clitheroe. It is bounded to the northwest by Chatburn Road, beyond which is greenfield land, to the southwest by scrub land, to the southeast by a business park, and to the northeast by the new Clitheroe Hospital.

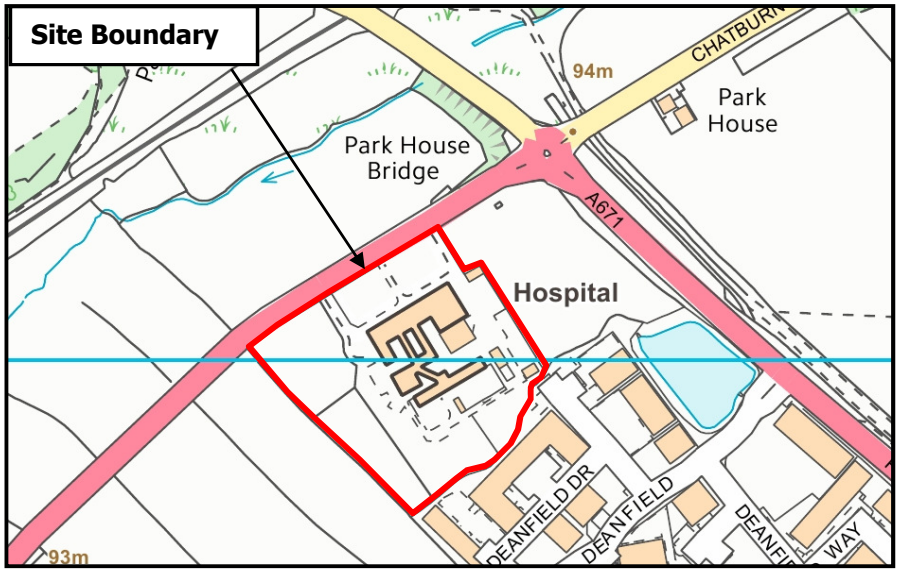


Figure 2 – Site Plan

A topographic survey was undertaken in September 2015 and this indicated that the highest point of the site was located near the south eastern corner of the site next to one of the existing buildings at a level of 98.08m AOD, and the lowest point lies near the north western boundary of the application site at a level of 93.46m AOD. The land on which the existing buildings are located is predominantly level, and the land fronting Chatburn Road falls towards the highway. Figure 1 below shows the direction of slopes across the application site, as well as the high and low points.

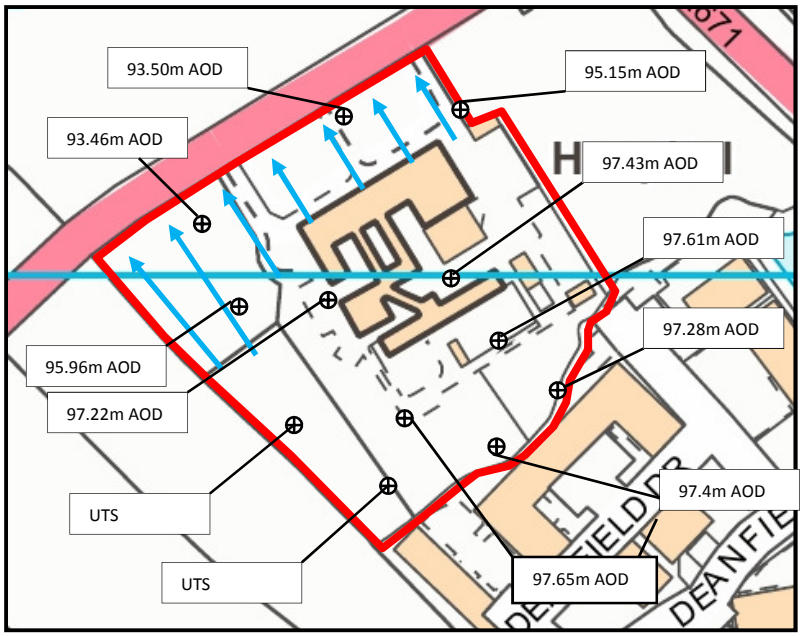


Figure 1 – Existing Site Levels and Approximate Falls within the Application Site

A copy of the Topographic Survey for the site is contained within Appendix B.

2.2 EXISTING DRAINAGE

2.2.1 Main Rivers

The nearest main river to the application site (as listed on the EA Flood Map for Planning) is an unnamed watercourse located approximately 110m to the north west of the site which flows in a south westerly direction and is a tributary of Mearley Brook.

2.2.2 Ordinary and Manmade Watercourses

The nearest ordinary watercourse to the site is located 90m north of the application site, and becomes Mearley Brook as it flows west to the north east of the application site and flows north into the un named watercourse described in Section 2.2.1.

2.2.3 Sewers

United Utilities Sewers

Inspection of the United Utilities (UU) Sewer Records have identified a 225mm diameter surface water sewer to the east of the application site draining through the new Clitheroe Community Hospital to the east of the site in a north westerly direction. The records indicate that this discharges into the watercourse to the northwest of the application site, and a recent drainage survey supports this. A 225mm diameter combined sewer (also confirmed through a drainage survey) is located to the southwest of the application site, and drains in a north westerly direction, connecting to a 225mm diameter combined sewer draining in a south westerly direction along Chatburn Road.

A copy of the sewer records received from UU is contained in Appendix C.

Highway Drainage

Within Chatburn Road there is a 150mm diameter highway drain which drains north east and discharges into the existing headwall of the unnamed watercourse approximately 90m to the north of the application site.

Private Sewers

A drainage survey was undertaken to identify how the existing site is drained and this indicated that the application site is drained by a combined system discharging into a 150mm diameter combined sewer located within Chatburn Road which drains to the south west along Chatburn Road eventually discharging into United Utilities combined sewer mentioned above.

A copy of the drainage survey results is contained within Appendix D.

3 FLOOD RISK

3.1 FLUVIAL FLOOD RISK

Fluvial flood risk is the risk arising from rivers and watercourses.

A floodplain is the area that would naturally be affected by flooding if a river rises above its banks. In England, floodplains are divided into flood zones (FZ) for planning purposes. These areas show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. They are divided as follows:

- Flood Zone 3 shows the land having a 1 in 100 or greater annual probability of river flooding.
- Flood Zone 2 shows the additional extent of an extreme flood from rivers. It is land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding;
- Flood Zone 1 is the area where flooding from rivers and the sea is very unlikely.

The EA Flood Map for Planning show that the application site is in Flood Zone 1. Hence it is considered that is at low risk of flooding from fluvial sources.

3.1.1 Ribble Valley Borough Council - Strategic Flood Risk Assessment 2010 (SFRA)

A review of the Ribble Valley Borough Council SFRA (dated May 2010) was undertaken to identify any flood risks associated with the application site that are required to be considered in providing flood mitigation and establishing an adequate surface water drainage strategy.

a) Map 1 of the SFRA confirms that the application site lies in Flood Zone 1. This is shown in Appendix E.
b) The SFRA provides no evidence that the application site is at risk of surface water flooding.
c) The SFRA does not indicate that the application site has suffered from sewer flooding historically.
d) Map 1 indicates that the application site has not been affected by any historical flooding events.
e) The SFRA states that groundwater is not considered to be a significant flood risk in the RVBC area.

3.1.2 Lancashire County Council - Preliminary Flood Risk Assessment (PFRA)

A review of the Lancashire County Council Preliminary Flood Risk Assessment dated August 2011 does not highlight any flooding events in Clitheroe and no additional specific flood risks to the site were identified within this document.

3.2 SEWER FLOODING

Neither the SFRA nor the PFRA indicated any specific records of sewer flooding affecting the site; therefore, the risk of sewer flooding to the application site is considered low.

3.3 SURFACE WATER FLOODING & OVERLAND FLOWS

Surface water flooding occurs where high rainfall events exceed the drainage capacity in an area (i.e. sewer system and/or watercourse), leading to flooding.

An extract of the Environment Agency's Updated Flood Map for Surface Water is shown below in Figure 4.

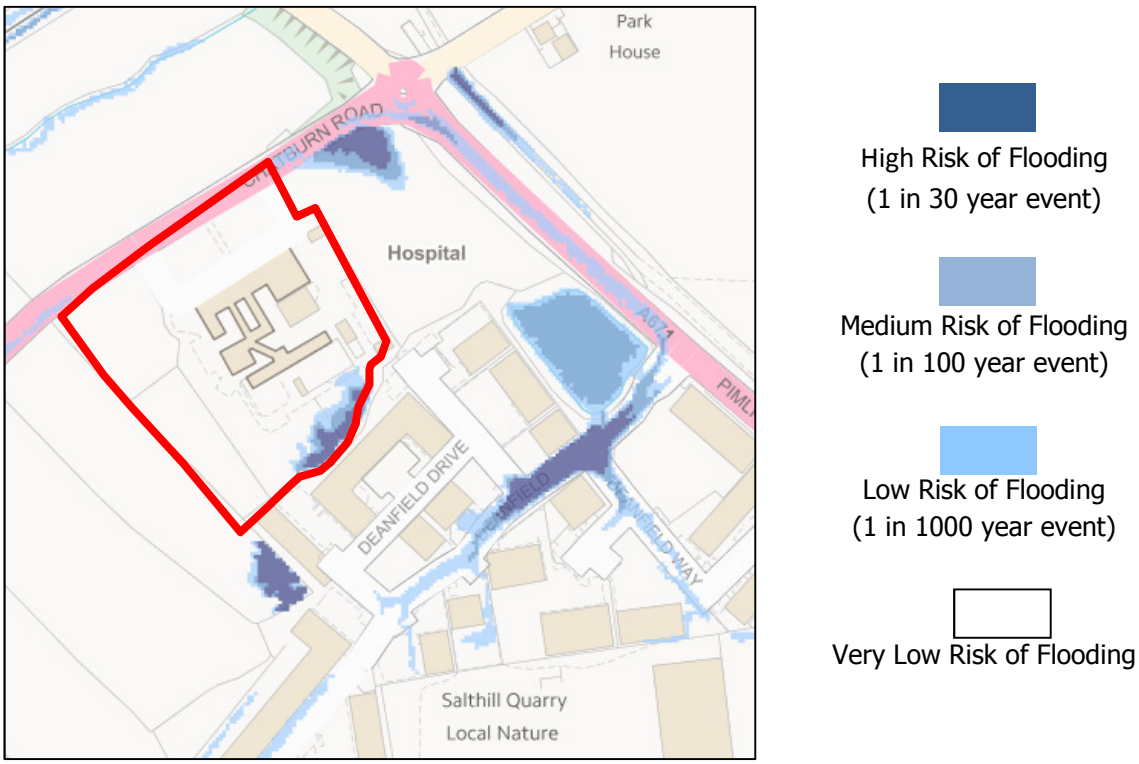


Figure 4 - Extract from the EA's Updated Flood Map for Surface Water (May 17)

Figure 4 indicates that most of the application site is at very low risk of surface water flooding, with isolated areas within the south eastern part of the site shown as being at risk. This is presumed to be a result of isolated low lying areas of the land as shown by the topographic survey.

Both the SFRA and PFRA show no evidence that the application site has suffered from surface water flooding. The redevelopment of the site will provide a drainage system that ensures that there is no surface flooding during any rainfall event up to and including the 1 in 30 year return period event.

The land to the north west and east falls away from the application site, and the land to the south is a development assumed to be drained to a 1 in 30-year standard, therefore the application site is not considered to be at any risk of overland flooding.

3.4 GROUNDWATER FLOODING

The WYG Site Investigation undertaken in February 2017 identified the underlying ground to consist of made ground overlying slightly silty sandy Clays overlying limestone and mudstones. Subsequent ground water modelling identified ground water at depths between 3.36m and 1.2m below ground level, with the higher groundwater level being along the north eastern boundary.

The SFRA does not indicate any recorded instances of groundwater flooding affecting the application site nor the adjacent area, therefore it is concluded that the risk of groundwater flooding affecting the application site is low.

3.5 RESERVOIR FLOODING

Although the probability of a catastrophic dam failure is considered to be extremely low, the consequence of such an event would be severe. A review of the EA online 'Risk of Flooding from Reservoirs' identified that the application site is not located within a zone at risk of reservoir flooding.

3.6 SUMMARY OF FLOOD RISK

3.6.1 Overview of Flood Risk

Based on the above it can be seen that the application site is considered to be at low risk of flooding from fluvial sources, overland flows, sewers, groundwater, and reservoir failure. An area of the site is shown as being at risk of flooding from surface water. Section 4 below indicates the proposed surface water drainage measures for the site, which will mitigate the risk shown by the EA flood maps for surface water.

It will be essential to ensure that no increase in flooding occurs downstream of the site as a result of the development and this matter is discussed in more detail within Section 4.

4 DEVELOPMENT PROPOSALS

4.1 PROPOSED DEVELOPMENT

The proposed development is to consist of 60 residential units comprising a mix of 2, 3, 4 and 5 bedroom units together with associated landscaping and infrastructure.

The application site is currently occupied by derelict buildings associated with the former Clitheroe Community Hospital and its existing associated infrastructure, thus the site is regarded as a brownfield development.

The proposed development is classified as "More Vulnerable" in accordance with Table 2 of the PPG - Flood Risk & Coastal Change (PPG).

A copy of the Proposed Site Layout Plan is contained in Appendix A.

4.2 SEQUENTIAL & EXCEPTION TEST

One of the aims of the PPG is to steer development away from zones of high flood risk towards Flood Zone 1. According to Table 2 of the PPG (Flood Risk & Coastal Change), the development is classified as 'More Vulnerable', and given that the application site is located entirely in Flood Zone 1, according to the current EA Flood Map for Planning, the proposed development elements are all considered appropriate in flood risk terms.

Based on the above it can be shown that the development proposals comply with the requirements of Table 3 of the PPG (Flood Risk & Coastal Change) by locating all development within the Flood Zone 1 areas and therefore the Sequential Test is considered to have been passed and there is no requirement to apply the Exception Test.

4.3 REVIEW OF PLANNING POLICIES

Policy DME6: Water Management of the Ribble Valley Core Strategy states that:

- Development will not be permitted where the proposals would be at an unacceptable risk of flooding exacerbate flooding elsewhere. Applications for development should include appropriate measures for the conservation, protection and management of water such that development contributes to:
    - Preventing pollution of surface and / or groundwater
    - Reducing water consumption
    - Reducing the risk of surface water flooding (for example using SUDS)
    - The council will also seek protection of watercourses for biodiversity value.

- All applications for planning permission should include details for surface water drainage and means of disposal based on SUDS principles. The use of the public sewer system is the least sustainable form of surface water drainage; therefore, development proposals will be expected to investigate and identify more sustainable alternatives to help reduce the risk of surface water flooding and environmental impact.

4.3.1 Lancashire & Blackpool Local Flood Risk Management Strategy 2013

Lead Local Flood Authorities have a duty to prepare a LFRMS that states how the LLFA intends to approach flood risk management during a set period. The joint strategy for Lancashire and Blackpool dedicates a section to Spatial Planning and Sustainable Drainage; which includes a set of objectives for the councils, such as '*Manage development so that it reduces flood risk'* and '*Promote the use of SuDS'.*

4.4 DEVELOPMENT AND FLOOD RISK

4.4.1 Flood Risk to the Development

As discussed in Section 3.6.1, the site is considered to be at low risk of fluvial flooding, groundwater, sewer, overland flows, and reservoir failure. Additionally, in accordance with the requirements of the PPG and the NPPF, it is essential that the development of the site does not increase the risk of flooding off site.

4.4.2 Flood Risk Arising from the Development

The new development will result in the development of a part greenfield, part brownfield site in flood risk terms. In line with the requirements of the DEFRA Non Statutory Technical guidance on SUDs, the rate of surface water run off from the development site is to be restricted to the pre development greenfield rate of run off.

On site attenuation is therefore to be provided within the application site to ensure that the proposed surface water drainage system does not exacerbate flood risk outside of the extent of the proposed development for all storm events up to and including the 1 in 100 plus 30% allowance for climate change storm event.

4.5 ASSESSMENT OF PRE AND POST DEVELOPMENT AREAS

The application site covers an area of 1.97ha and is currently 43% impermeable; and the impermeable area of the proposed re – development is 0.82 ha. Table 1 below shows the pre and post development permeable and impermeable areas for the application site.

In accordance with the requirements of the DEFRA Non Technical Standards for Sustainable Drainage, the post development discharge rate is to be based on the existing pre development greenfield discharge rate and therefore no allowance will be made for the existing surface water run off from the existing impermeable areas.

Table 1 – Pre and Post Development Areas for Application Site

Status	Impermeable Area (Ha)	Permeable Area (Ha)
Pre Development	0.86	1.11
Post Development	0.82	1.15

The above proposed post development impermeable areas have been adopted in assessing the preliminary on site attenuation volumes.

4.5.1 Existing Discharge Rates

The existing peak greenfield run off rate for the 1.11 ha permeable greenfield part of the site has been calculated using the ICP SUDs module of the Micro Drainage software package, with the peak run off per hectare for a number of key storm events summarised as follows:

a) 1 in 1 year = 6.5 l/s/ha

b) 1 in 30 year = 12.7 l/s/ha

c) 1 in 100 year = 15.6 l/s/ha

d) Q_{bar} = 7.5 l/s/ha

The above green field run off calculation is contained in Appendix F of this report.

The Q_{bar} value of 7.5 l/s/ha been adopted as the maximum post development discharge rate in assessing the required on site surface water attenuation, although this will be restricted to the proposed post development impermeable areas.

4.5.2 Proposed Discharge Rates

It is proposed to discharge surface water run off from the impermeable areas of the site at existing green field rates in accordance with the requirements of the DEFRA Non Statutory Technical Standards for Sustainable Drainage.

Table 2 – Proposed Discharge Rates

Area (ha)	1.97
Post Development Impermeable Area (including 10% Urban Creep allowance)	0.82
Existing greenfield run off rate for site Qbar per hectare (l/s/ha)	7.5
Greenfield Run off rate (Qbar) for Total Site Post Development Impermeable Area (l/s)	6.17
Proposed Discharge Rate (l/s)	**6.17**

4.6 PROPOSED MITIGATION

4.6.1 Flood Risk due to Surface Water Runoff from the Site

In order to ensure that surface water runoff from the site does not cause an increase in flood risk, the management of runoff has been considered via a sequential approach, in line with Building Regulations. The following options for the disposal of surface water runoff were considered, in order of preference[2]:

i) A soakaway or some other infiltration system;

ii) A watercourse;

iii) A sewer.

4.7.1.1 Discharge to soakaway

This is the preferred method for disposal of surface water run off, however, infiltration is considered unlikely to be viable due to the underlying ground conditions which consist of made ground overlying slightly silty sandy Clays to a depth of 4m below ground level.

A review of the EA's Ground Water Source Protection Zone (GWSPZ) map for the development site location shows that the site is not located within a Groundwater Source Protection Zone.

4.7.1.2 Discharge to Watercourse

Two surface water drainage strategies are being proposed, both of them discharging surface water from the proposed impermeable surfaces of the site to the watercourse to the north of the site at the existing greenfield run off rate of 6.17 l/s.

[2] Building Regulations H3(3), Rainwater drainage

4.7.1.3 Discharge to Sewer

Both options involve eventually discharging the surface water run off to an existing watercourse via a new sewer system.

As the existing site discharges to a combined sewer, the proposed development will provide a significant betterment by reducing the existing surface water run off that drains into the United Utilities combined system.

4.7 SURFACE WATER DRAINAGE STRATEGY

It is proposed to discharge surface water from the proposed 0.82 ha impermeable area of the site to the watercourse to the north of the site at the Q_{bar} greenfield run off rate of 6.17 l/s.

Initially, it is proposed to locate a detention pond within the area of public open space to provide attenuation storage to contain surface water run off from rainfall events up to and including the 1 in 30-year storm event. In addition to the detention pond, an underground attenuation tank will be provided under the public open space to retain exceedance flows from rainfall events up to and including the 1 in 100 year plus climate change event. Therefore, the proposed drainage ensures that there will be no flooding within the application site during any event up to the 1 in 100 year plus climate change event.

Two options have been identified to discharge surface water runoff from the pond to the watercourse. Hence, the options are shown to demonstrate the feasibility of discharging to the watercourse instead of to the combined sewer.

1) Provision of a new sewer under third party land (the adjacent hospital site) to the watercourse. This options does not require works in the highway.

2) Provision of a new sewer under Chatburn Road.

The proposed surface water drainage strategies are contained in Appendix G.

4.7.1 Assessment of Post Development Surface Water Attenuation Volumes

In order to provide an estimation of the future attenuation volumes required, a preliminary assessment using the Micro Drainage modelling programme has been undertaken.

Table 3 below provides a summary of the estimated attenuation storage volumes required for the application site based on the impermeable areas and proposed discharge as listed in Table 2.

Table 3 – Summary of Micro Drainage Quick Storage Calculations

Impermeable area (ha)	Allowable discharge rate (l/s)	1 in 30 year storage (m^3)	Additional storage required to satisfy 1 in 100 (plus 30% CC) exceedance flows (m^3)	Total storage to satisfy 1 in 100 (plus 30% CC) exceedance flows (m^3)
0.82	6.17	250	250	500

A copy of the preliminary Micro Drainage Quick Storage calculations is included in the Appendix H.

4.7.2 Minimum Finished Floor Levels & Overland Flood Route

In setting the final external levels for the development it is important to ensure that if flows in exceedance of the 1 in 100 years plus 30% allowance for climate change storm event occur or a failure of the site surface water drainage system occurs, that suitable overland flood routes are provided within the development to ensure no localised flooding of the buildings occurs within the development.

It is therefore proposed to direct overland surface water flows to the tributary to Mearley Brook to the north of the application site, given that the site naturally drains in that direction. The site levels and layout will be set in order to maintain an overland surface water flood path through the development out to the tributary. Additionally, it is proposed that the finished floor levels of the new buildings are to be set 150mm above the average ground level, which will ensure that in the event of extensive overland flows, no flooding of the buildings will occur. Additionally, by installing a suitable surface water drainage system, this should deal with any potential surface water flooding issues on site.

4.8 RESIDUAL FLOOD RISK

If the above mitigation measures are provided as part of the development, it is considered that the primary residual failure would be as a result of some type of failure of the site drainage system during the life of the development. Regular, ongoing maintenance will therefore be required to ensure that the capacity of the system is maintained as it has been designed.

In addition, as discussed above there remains a residual risk of a storm event that exceeds the capacity of the drainage system, as events beyond the 1 in 100 year plus 30% allowance for climate change storm event will not be catered for explicitly.

4.9 FUTURE MAINTENANCE RESPONSIBILITIES

As it is anticipated that upon completion of the development the surface water sewers will be adopted under a Section 104 agreement with United Utilities, responsibility for the maintenance of the new surface water drainage systems will eventually be with United Utilities.

Maintenance and adoption of SUDs will be covered in Section 5.

5 SUDS

5.1 SUDS AND DESIGN PRINCIPLES

It is proposed to incorporate a fully compliant SUDS strategy where economically viable[3] in relation to the discharge of surface water drainage from the proposed development.

This section will also seek to identify some of the SUDS systems and techniques which are to be considered and reviewed as part of the proposed detailed surface water drainage design and subsequent planning application for the development site.

5.1.1 The SUDS Management Train

The overarching principles of a SUDS system are to minimise the impacts arising from the development on the quantity and quality of the development surface water run-off, whilst at the same time replicating the natural drainage from the site before development.

SUDS key objectives are to minimise the impacts from the development on the quantity and quality of run-off and to maximise amenity and biodiversity opportunities.

The accepted SUDS management train consists of three elements:

Source Control

- Water butts, green roofs, filter drains, pervious surfaces, swales, rain water harvesting

Site Control

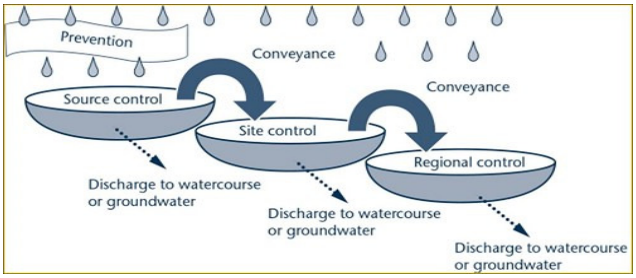
- Swales, ponds, wetlands, infiltration devices

Regional Control

- Basins, ponds and wetlands
- Reservoirs

The following is an illustration of these principles and how they may be applied to a development via a SUDS Management Train.

[3] Reasonable and "what is reasonably practical" is as set out within paragraphs 082,083,084 and 085 of the PPG (Flood Risk & Coastal Change) and compliance with the Technical Standards (i.e. DEFRA Non Statutory Technical Standards for Sustainable Drainage) will be regarded as not practical, if the cost of compliance exceeds the cost of compliance with Building Regulations (unless compliance is necessary where there is a risk of flooding requiring the development to be safe and to avoid flood risk elsewhere).



Various methods are currently available for source, site and regional control. A review has been undertaken of how best the various systems and sub techniques could be incorporated into the proposed surface water management design and these are set out below:

Table 4 – Proposed SuDS Elements

Type of SUDS	Description	Applicability to the Site
Detention basins/ponds	Shallow areas of open space that temporarily hold water and collect silt	Detention ponds are being considered to provide on site attenuation.

As the proposed SUDS strategy will only be seeking to utilise source and site wide methods, regional methods have not been considered.

5.2 PROPOSED SURFACE WATER DRAINAGE PRINCIPLES

The rate of run off is proposed to be limited to a greenfield run off rate of 6.17 l/s for the proposed post development impermeable area.

As discussed in Section 4, the surface water drainage strategy seeks to dispose of surface water through discharge of surface water to the watercourse to the north of the site, using a detention basin to provide attenuation storage and water quality benefits.

Infiltration, subject to a full ground investigation, has been discounted due to the underlying ground identified within the WYG site investigation study.

Detention Ponds

Detention ponds (also known as detention basins) are dry basins that attenuate storm water run-off by providing temporary storage and controlled release of detained runoff. They are normally vegetated depressions (i.e. grass) that remain mainly dry, except during and immediately after storm events. The detention pond may also incorporate a small permanent pool of water at the outlet to prevent re-suspension

of sediment particles by high intensity storms and to provide enhanced water quality treatment for frequent storm events.

Lined detention ponds may be provided with a depth of approximately 1.5m, and side slopes of approximately 1 in 3, and subject to the final design, may incorporate shallow ledges.

The ponds will be designed to incorporate a shallow dished section within the central part to allow low flows to drain to the outfall. At times of high rainfall the pond will fill up to provide the required attenuation and then drain down to maintain a grassed area for general amenity use.

In order to provide access for maintenance to the ponds inlet and outlet structures, vehicular access will be provided around the structure utilising a grass grid or similar pavement system.

5.3 FUTURE SUDS MAINTENANCE RESPONSIBILITIES

It is anticipated that future SUDS maintenance will be undertaken by a private management company with each property owner contributing to the maintenance of the SUDS features and this requirement will be included within the title registration of the property.

To support the above, a full inspection and operation manual will be provided setting out the proposed schedule of inspection and maintenance and who will be responsible for executing these elements. Table 5 below provides a summary of the maintenance required by the elements of the drainage network.

Table 5 - Maintenance tasks and frequency required

SuDS element	Maintenance Task	Recommended Frequency
Ponds/Basins	- Remove litter and debris - Cut grass & vegetation management - Inspect inlets, outlets and structures - Remove sediments from inlet and outlet - Prune and trim trees - Remove sediments from main basin - Repair erosion and other damages - Relevel surfaces	- Monthly - Monthly in Spring and Summer or as required - Every 12 months - Every 5 years - As required
Underground Tank	- Remove debris from catchment surface - Remove sediment from pre treatment structures - Inspect inlets and outlets - Survey inside of the tank	- Every 12 months - Every 5 years

6 FOUL DRAINAGE ASSESSMENT

6.1 EXISITING FOUL DRAINAGE

As stated within Section 2.2.3 the existing site is drained by a combined system which in turn drains into a 150mm diameter combined sewer draining west along Chatburn Road, which in turn discharges into the existing 225mm diameter combined sewer located to the west of the site within Chatburn Road.

A copy of the sewer records received from UU is contained in Appendix C.

6.2 PROPOSED POST DEVELOPMENT FLOWS

The application site is to consist of 60 residential units. Based on a peak flow of 0.0462 l/s per residential unit (refer to Sewers for Adoption 6th Edition), the peak foul flow has been assessed as being 2.77 l/s. It is proposed to discharge foul flows from the application site to the existing 225mm diameter combined sewer located in Chatburn Road, as shown in Appendix G.

6.3 UNITED UTILITIES WATER PRE DEVELOPMENT ENQUIRY

A pre development application enquiry has previously been submitted to United Utilities to confirm the point of connection and that there is adequate capacity within the receiving wastewater network for up to 150 units. In their response, UU stated that

- Foul will be allowed to drain to the public combined / foul sewer network, with the preferred discharge point being the 225mm diameter foul sewer in Chatburn Road at an unrestricted rate.
- Surface water from the site should drain either to a soakaway or directly to a watercourse. Discharge rates and consents must be agreed with all interested parties.
- Although UU may agree discharge points and rates in principle, it will be necessary to apply for a formal sewer connection so that UU can assess the method of construction, health and safety requirements, and to ultimately inspect the connection when it is made.
- Adoption is assessed based on Sewer for Adoption 6th Edition.

The consultation issued and the response is contained in Appendix I.

7 CONSENTS REQUIRED

7.1 SECTION 106 WATER INDUSTRY ACT 1991

Any new connection to the United Utilities public sewer system will require a Section 106 application under the Water Industry Act 1991.

7.2 SECTION 104 OF THE WATER INDUSTRY ACT

The foul and surface water system within the proposed development is to be constructed to adoptable standards such that it can at a future date be adopted by United Utilities. As such, the proposed foul and surface water sewers will be subject to an agreement under S104 of the Water Industry Act 1991.

7.3 LAND DRAINAGE CONSENT

In respect to the construction of any new surface water outfall into the existing watercourse, it will be necessary to obtain a Land Drainage Consent from the LLFA and also consent will also be required in relation to the proposed discharge rate of 5 l/s from the riparian owner of the watercourse.

7.4 LANCASHIRE CC HIGHWAYS

The laying of a new sewer within Chatburn Road will require to be agreed with Lancashire CC Highways.

8 CONCLUSIONS & RECOMMENDATIONS

This report has identified the following conclusions:

- The development site is shown on the EA Statutory Flood Maps for Planning as being entirely within Flood Zone 1.
- The proposed development is to consist of 60 new residential units together with associated infrastructure and landscaping on the 1.97 ha brownfield site.
- The existing & proposed developments are classified as 'More Vulnerable' according to Table 2 of the NPPG (Flood Risk & Coastal Change).
- The highest point of the site is located near the south eastern corner of the site next to one of the existing buildings at a level of 98.08m AOD, and the lowest point lies near the north western boundary of the application site at a level of 93.46m AOD.
- The nearest main river to the application site (as listed on the EA Flood Map for Planning) is an unnamed watercourse located approximately 110m to the north west of the site which flows in a south westerly direction and is a tributary of Mearley Brook.
- The nearest ordinary watercourse to the site is located 90m north of the application site, and becomes Mearley Brook as it flows west.to the north east of the application site and flows north into the un named watercourse described above.
- There are no historical records of any flooding within the application site.
- The application site is considered to be at low risk of flooding from fluvial sources, and at low risk of flooding from ordinary watercourses, sewer flooding, overland flooding, groundwater sources, and reservoir failure.
- The application site is underlain by superficial deposits of till, and a bedrock of Limestone. The site is not located within a Groundwater Source Protection Zone. The application site is located in a Major Aquifer Low Groundwater Vulnerability Zone.
- The existing Q_{bar} rate of discharge per hectare is estimated to be 7.5 l/s.
- It is proposed to discharge surface water run off from the estimated 0.82 ha post development impermeable area(including a 10% allowance for urban creep) at a rate of 6.17 l/s.
- It is proposed to dispose of surface water run off from the site eventually discharging to the tributary to Mearley Brook to the north east.
- It is proposed to provide attenuation in a SUDs pond that will store rainfall events up to the 1 in 30-year rainfall event.
- Exceedance flows up to the 1 in 100 year plus climate change event will be stored in underground attenuation tank located under the public open space.
- It is proposed to discharge foul flows to the existing combined sewer draining along Chatburn Road. The peak foul flow rate has been calculated to be 2.3 l/s.

Based on the above, the following recommendations are made:

- Finished Floor Levels of the new buildings are to be set at 150mm above the average ground level to ensure that in the event of exceedance events causing overland flows within the development, no flooding of the properties will occur.
- The site is to be graded such that overland flows proceed through the site towards the watercourse to the north east of the site.
- On completion, a regular inspection & maintenance regime is to be provided together with details of who will be responsible for the inspection and maintenance of the proposed SUDs components.
- A legal agreement should be obtained with the riparian owner should a new surface water sewer be laid along Chatburn Road and discharging into either the existing culverted watercourse within Chatburn Road or alternatively to the existing outfall.
- Land Drainage Consent from the LLFA will be necessary in order to discharge to the watercourse.