

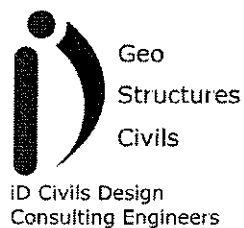
Report: 3746/FRA1

Date: October 2012

320120964P

**FLOOD RISK ASSESSMENT AND SURFACE WATER MANAGEMENT STRATEGY
FOR PROPOSED RESIDENTIAL DEVELOPMENT
at
WHALLEY ROAD, HURST GREEN**

**Prepared for
STONYHURST COLLEGE**



**iD Civils Design Ltd
The Stables
Aske Hall
Richmond
North Yorkshire
DL10 5HG**

Tel: 01748 889010
Web: id-gsc.co.uk

Issue Record

Prepared By	Date
Darren Linklater	16 th October 2012
Checked By	Date
John Batty	16 th October 2012

Revisions		Date
A	Draft Issue	16.10.12

TABLE OF CONTENTS

1	INTRODUCTION	3
2	BACKGROUND	3
3	REGULATORY GUIDANCE	4
4	SITE DESCRIPTION AND HISTORY	6
5	EXISTING SITE DRAINAGE	7
6	PROPOSED DEVELOPMENT	10
7	FLOOD SOURCES AND SITE VULNERABILITY	10
8	FLOOD IMPACT AND MITIGATION MEASURES	11
9	SUDS	11
10	PROPOSED DRAINAGE STRATEGY	13
11	IMPACT OF DEVELOPMENT AND RESIDUAL RISK	15

APPENDICES

A	Site Location Plan
B	EA Flood Zone Plan
C	Topographical Survey
D	Adoptable Sewer Records (UU)
E	Site Layout Plan
F	Drainage Outfall Plan

**FLOOD RISK ASSESSMENT AND
SURFACE WATER MANAGEMENT STRATEGY REPORT
FOR PROPOSED DEVELOPMENT
at
WHALLEY ROAD, HURST GREEN**

1 INTRODUCTION

- 1.1 iD Civils Ltd (iD), have been appointed by Carter Jonas (CJ) on behalf of Stonyhurst College(SC) to prepare a Flood Risk Assessment (FRA) and surface water drainage management strategy report for the proposed residential development at Whalley Road, Hurst Green.
- 1.2 The report will be undertaken in accordance with Environment Agency (EA) guidance, United Utilities guidance and development control policy of the local authority, and will focus on:
- Site Use and Current Drainage regime, Flooding History, Ground Conditions and use of SUDS, Impact of development and proposed drainage strategy, flash flooding routes and the overall impact of development on the site and surrounds.
- 1.3 The report is for the sole use of Stonyhurst School and presents comments and conclusions based on information available at the time of writing. iD Civils reserve the right to amend conclusions if further information is made available.

2 BACKGROUND

- 2.1 SC is seeking outline planning permission to develop 2.39 Ha of land to the north of Whalley Road in Hurst Green. A location plan for the site is included in appendix A. The land is used as grazing land at present and comprises 2 separate fields to the east of Warren Fold and west of St Josephs Roman Catholic Primary School.
- 2.2 The development will include a range of residential dwellings of varying sizes and tenures. A master plan by Phil Rickinson Associates is included within appendix E.
- 2.3 This Flood Risk Assessment has been undertaken with reference to the site master plan layout (PRA), detailed topographical survey, sewer records provided by United Utilities (UU) and Flood Zone Plans published by the EA. In addition, iD Civils have undertaken a walkover survey of the site, and areas downstream, and liaised with UU with regards to potential drainage options. Commercially available aerial photographs and historic ordnance survey maps of the area have also been used during the preparation of the report.
- 2.4 **Site Walkover:** A site walkover was undertaken in September 2012. During the site walkover overland flood routes onto and from the site were inspected in order to assess the risk of flooding from external sources.

3 REGULATORY GUIDANCE

- 3.1 National Planning Policy Framework (NPPF), along with the Technical Guidance to the withdrawn PPS25 provides the regulatory framework and guidance for planning authorities in relation to Flood Issues for new developments. We have assumed that reference to tables and 'use categories' made in the Technical guidance to PPS25 are still current. Any application submitted to a local planning authority will be considered in conjunction with this guidance, and dependant on the nature and location of the application, the planning authority may request a Flood Risk Assessment as part of the planning application documents.
- 3.2 The Environment Agency is a statutory consultee to the Planning Authority in relation to flood risk issues. In addition many local authorities have their own internal Flood Department which would advise on drainage issues and work with the EA on strategic issues. The Land Drainage Act 1991 provides a regulatory framework for this issue.
- 3.3 The agency has produced a matrix for local planning authorities, which provides advice in terms of the requirements for risk assessment. 'Environment Agency Standing Advice – Development and Flood Risk' dated February 2009 tabulates the requirements relative to the scale of the development and the applicable Flood Zone. The assessment is required for all sites larger than 1 Ha in flood Zone 1 and all sites regardless of size in Flood Zones 2 and 3.
- 3.4 The Environment Agency have undertaken a national study of flood risk across England and published flood maps covering the country. The maps can be viewed on the agency web site at www.environment-agency.gov.uk. Specific locations can be studied by searching either using postcode or address.
- 3.5 The EA flood maps identify 3 zones.

Flood Zone 1: This zone comprises land with a less than 1 in 1000 annual probability of river or sea flooding in any one year (<0.1%)

Flood Zone 2: This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1%-0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5%-0.1%) in any year

Flood zone 3: The zone comprises land assessed as having a 1 in 100 year or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Flood risk should be assessed from the following sources; tidal and river, surface water and flooding from land, groundwater, sewers and artificial sources e.g. canals and reservoirs.

Flood zone plans reflect the undefended flood scenario for a particular area. Many flood areas are defended with flood defences of varying types and design life. Areas benefiting from flood protection are shown hatched on the EA plans.

- 3.6 The level of detail and complexity of a Flood Risk Assessment can vary considerably, dependant on the scale, nature and location of the planned development. EA guidance sets out the criteria for the level of information which should be included within the FRA.
- 3.7 The application site is within EA *Flood Zone 1*.

- 3.8 The Practice Guide to PPS25 refers to vulnerability classifications, which are based on the sensitivity of different forms of development. For the purposes of this report the classifications have been taken from the withdrawn PPS25 document. In accordance with the guide to PPS25, the intended end use planned for this development is classed as 'More Vulnerable' (residential). The site is therefore *appropriate within flood zone 1*.
- 3.9 **The Sequential Test:** In accordance with NPPF, LPA's allocating land for development should apply the Sequential test, to demonstrate that there are no available sites in the area with a lower risk of flooding.
- 3.10 **The Exception Test:** The exception test is relevant if, following the application of the sequential test; it is not possible for the development to be allocated in zones of lower probability of flooding. The exception test criteria are detailed in The Technical practice guide of PPS25. The test provides a method of managing flood risk while still allowing necessary development to occur.
- The test is not relevant in this particular instance.
- 3.11 UU work within the framework of 'Sewers for Adoption', which sets the standard for adoptable surface water and foul waters sewers. They also apply development control standards which are consistent with current best practice and Building Regulations.
- 3.12 Developers are encouraged to make 'pre development' enquiries to UU to ensure that there is sufficient time for the company to fully assess the capacity of their network and treatment works. This process also ensures that drainage strategies are acceptable in principle, prior to planning permission and helps avoid any objections from UU during the planning process.
- 3.13 The emerging 'Flood and Water Management Act 2010' will fundamentally change the way developers and local authorities approach the design and adoption of SuDS drainage. New SuDS Approving Bodies (SAB) will be formed to ensure adequate consideration is given to SuDS methods of drainage and the SAB will act to approve SuDS designs and adopt the constructed drainage. It is understood that the local authority may become the SuDS Approving Body for this site.
- 3.14 A new set of SuDS standards is currently out to consultation amongst stakeholders, and will be implemented later in the year. The 7th edition of 'Sewers for Adoption' will be issued following the adoption of the SuDS standards and will compliment the new standards. At this stage it is unclear what the programme for adoption of SAB's will be. Best estimate is Spring 2013, however this timescale may vary.
- 3.15 The principles identified in the consultation SuDS standards have been considered in developing the strategy outlined in this report, on the assumption that the strategy will be consistent with best practice and that ultimately the site will come forward after the SAB's are in place.

4 SITE DESCRIPTION AND HISTORY

- 4.1 A site location plan is included within Appendix A of this report. Site details are summarised in the Table below.

Table 3746.1 - Site Location Summary

Detail	Remarks
Location	0.2Km west of Hurst Green centre
NGR	SD 687 380
Area	2.39 Ha (5.9 Acres)
Current Use	Arable Farmland

- 4.2 **Topography:** The topographical survey and walkover survey indicate that the site is steeply sloping from north to south. The high point of the site is to the north eastern boundary at 111m AOD. The lowest point on the site is adjacent Whalley Road on the southern boundary at 101m AOD. Typical gradients across the site vary from 1:15 to 1:20.
- 4.3 The site is close to a ridge line in the local topography to the north. The area is currently used as grazing land and is divided into 2 fields with a boundary boundary hedge between. Whalley Road (B6243) runs east-west along the southern boundary of the site.
- 4.4 **Adjacent Land use:** The site is bounded by the following features:

Table 3746.2 -Adjacent Land Uses

North	Grazing Land. Ridge line approximately 20m north of development limits.
South	Whalley Road (B6243) with residential beyond
East	Access road to school with residential beyond
West	Warren Fold residential development.

- 4.5 **Previous Development:** iD Civils understand that there has been no previous development on the site.
- 4.6 **Existing Hard standing:** The site frontage has a tarmac parking area for school drop of traffic. The car park covers an impermeable area of 540m². The surface water run off details are not known and it is suspected that the run off will enter a highways drain and flow to a local watercourse.
- 4.7 **Hydrology:** There are no watercourses within the site. The nearest watercourse is approximately 50m south of the site. The watercourse is an unnamed tributary of the River Ribble. There are 2 further watercourses to the east and the west of the site approximately 250m from the site.

Given the use of the site there may be a network of land drainage below the fields. This is considered a low probability however given the field slopes which would promote overland flow of any surface water rather than ponding.

- 4.8 Whilst no intrusive investigation has been undertaken to date, groundwater levels are expected to be deep through the majority of the site, based on the relatively elevated position when compared to surrounding land.

5 EXISTING SITE DRAINAGE

- 5.1 iD has obtained a copy of the UU Sewerage Record plans for the area. A summary is presented below:

Table 3746.4 – Existing Sewers Summary

Sewer Type	Comment
Surface Water	There are no surface water sewers running through or close to the site. There may be a highway drain running in Whalley Road but no records of the drain are shown on the UU plan.
Combined	There are no combined sewers crossing the site. There is a combined sewer running from Warren farm south into Warren Fold to the west of the site. This sewer then passes through the crossroads and into a 225mm diameter system.
Foul Water	There are no foul sewers crossing the site or close to the site.
Highway Drains	The topographical survey indicates manhole covers within Whalley Road to a presumed highway drain. There are a number of highway gullies along Whalley Road and it is assumed that this drain flows to the east to the watercourse.

- 5.2 The EA/Defra R+D Technical Report W5-074/A/TR/1 'Preliminary Rainfall runoff management for developments' reviews the various methodologies for derivation of greenfield runoff from development sites. The report recommends (table 9.1) that for catchments of less than 50 Ha, the Institute of Hydrology Report 124 is the appropriate methodology. Where developments are smaller than 50 Ha, Greenfield rates should be based on 50 Ha with a linear interpolation to suit the site area.
- 5.3 The assessment of Greenfield runoff is a complex issue, which can be influenced by many site specific factors. IoH 124 provides a robust assessment tool, but cannot factor in site specific influences which may be relevant to a particular development and setting within the flood zone. IoH124 has been developed following a study of 71 small rural catchments and is considered to be an appropriate basis for an assessment of Greenfield runoff. The tool is based on rainfall hydrographs and soil types for a particular location. It does not consider site specific gradients, connectivity with the receiving watercourse, or any other site related constraint.
- 5.4 The site features significant open space and landscape corridors. Whilst the final layout and design is subject to approval, the plan in appendix E provides an approximation of the split between developed and undeveloped parts of the site. The total developed area is approximately 1.9 Ha, with approximately 0.47 Ha of peripheral open space and landscaping. The following greenfield assessment is based on 1.9 Ha.

Using IoH 124 method, the site produces the following Greenfield run-off rates:

Table 3746.5 – Greenfield Run-off using IoH 124

Return Period	Flow rate (litres/sec)
1 year (rural)	12.4
30 year	25.4
100 year	30.0

5.5 *Greenfield Flow Components:* As discussed above, IoH124 does not factor in site specific linkages or flow routes. Assessment of Greenfield flows from a site is very complex and flows can reach a receptor in a number of ways and to varying rates. i.e.

1. Flows via groundwater table – Water can flow to the receiving watercourse or groundwater table via percolation through the natural strata below the site. This mechanism is reliant on the infiltration characteristics of the soil. On flat sites, with undulating surface topography this will be the primary mechanism for Greenfield flows as water sits on the site and percolates downwards to the water table and ultimately to the watercourse.
2. Flows via Overland Flow – On sloping sites where there is little infiltration, water falling on the site can flow overland to a low point, particularly when the ground is saturated or conversely when there has been a dry spell and the ground surface is hardened. The percentage runoff from the site is approximately equal to the SPR value of the soil type. SPR values are given in the Flood Studies Report (FSR) or the Flood Estimation Handbook (FEH). SPR values are given in five categories (1-5) with impermeable clays being rated as 5 and granular soils 1. The SPR values are as follows:

Table 3746.6 – SPR Values

Category	SPR
1	0.10
2	0.30
3	0.37
4	0.47
5	0.53

3. Flows via indeterminate pathways – Groundwater can reach the receptor via many different sub strata pathways i.e granular bedding around pipes and cables, sand lenses in the ground, fault lines and service routes.

- 5.6 **Site Linkages:** The proximity of sites to the ditch/watercourse network and to the ultimate receptor is a key consideration. If a site is within close proximity of a ditch network flows can reach the receptor quicker than a site which is remote and has no linkage.
- 5.7 **Site Specific Factors:** Whilst a full quantitative assessment of the flows between the site and the receiving watercourses is not possible due to the unknown ground conditions/land drainage regime, a more specific assessment of Greenfield components than possible in IoH 124 can be made. Of particular relevance to this site is the likely overland component of the site flows due to the site slopes down to the highway which will form a conveyance route either through highway drainage or overland to the watercourse. There will be a significant overland flow component which will discharge to the south onto Whalley Road. In addition the school car park/drop off area will provide a positive run-off to the highway drain or road gulley network.
- 5.8 The Greenfield element of the site (development area only) which slopes steeply has a total catchment flowing to the south of 1.90 Ha, and utilising a SPR value of 0.47 will generate a flow of 124 l/s during a 1 in 1 year event. Making an allowance for any flow restriction due to furrows in the field, it is likely that overland flows may be in the order of 80 l/s.
- 5.9 In addition the car parking area adjacent to Whalley Road is positively drained by a gulley which is presumed to connect to the highway drain. Based on a catchment area of 540m² and typical rainfall of 50mm/hr, the car park will produce surface water run off of 7 litres/second.
- 5.10 The total pre development existing flow rate from the site may be as high as 80-90 l/s dependant on ground saturation, flow conditions and the efficiency of the highway drainage system.
- 5.11 The analysis of greenfield flow rates is a complex assessment, and dependant on the methodology used can give varying results. The site is close to a number of watercourses and sits on the top of a hill. It is considered that the amount of overland flows reaching the watercourse to the east will be significant due to the potential for overland flows in the highway corridor. The watercourse sits at the bottom of a low spot in the highway alignment and a direct flow path is created due to the highway topography.
- 5.12 On the basis that the IoH 124 methodology represents a 'conservative approach' to the assessment and the prevention of increases in flood risk is paramount, it is considered that for the purposes of this assessment the IoH 124 Greenfield figure for the developed areas of the site of 12.4 l/s should be utilised. In addition to the Greenfield component there is also run off of 7 l/s from the car park which is likely to drain to the adjacent highway drain. The total pre development run of rate is therefore 19.4 l/s.
- 5.13 As flow attenuation systems generally feature a single flow control device which restricts design flows to the 1 in 1 year pre development scenario, the storage system offers significant further protection when considering storms in excess of the 1 in 1 year event.

6 PROPOSED DEVELOPMENT

- 6.1 The proposed development is 'typical' residential estate development i.e. not high density inner city or infill development. There are substantial landscape/POS areas around the site and from experience it is anticipated that the net impermeable area will be in the order of 55% of the gross developable area. This results in a net impermeable area assumption of 0.95 Ha for the purposes of this assessment. Detail calculation of drainage catchments will be undertaken in the detailed drainage design stage.
- 6.2 Vehicular access to the site will be via a single new access from Whalley Road. Highways within the site will be offered for adoption under a section 38 agreement with the highway authority. Foul and surface water sewers will be offered for adoption with UU under a section 104 agreement.

7 FLOOD HISTORY AND SITE VULNERABILITY

- 7.1 Flooding can occur from a variety of sources, including tidal, rivers, watercourses, overland run-off, sewers and culverts. NPPF and local authority guidance requires flood risk from all sources to be evaluated and suitable mitigation provided.
- 7.2 Inspection of the EA flood map indicates that the site falls within Flood Zone 1 with a low risk of flooding.
- 7.3 NPPF provides guidance with respect to the implications of climate change and suggests appropriate additional allowances for climate change with respect to rainfall intensities. It also recommends the following precautionary sensitivity ranges are applied to rainfall intensities for the design life of the development:

Table 3746.7 – Climate Change Allowances

Parameter	1990-2025	2025-2055	2055-2085	2085-2115
Peak Rainfall Intensity	+5%	+10%	+20%	+30%
Peak river Flow	+10%	+20%		

- 7.4 Practice Guidance to PPS25 indicates that residential development should be considered to have a design life of 100 years, and therefore a climate change allowance of 30% is required in all drainage assessments.

8 FLOOD IMPACT AND MITIGATION MEASURES

8.1 NPPF guidance requires the risk from a range of potential sources to be evaluated, as follows:

8.2 **Overland Flooding:** Based on the site walkover survey, review of the topographical survey, the risk of flooding onto the site from adjacent land is considered low due to the location of the site close to a high ridge. Land to the north falls towards the site but there is very little catchment before the ridge so flows generated will be low. Land to the west, east and south is lower than the site.

The site may generate flows onto the lane which forms the eastern boundary however the lane falls towards Whalley Road and flows will pass along the highway corridor.

Where roads run across the contours i.e. up/down hill they can form a flood route and particular care should be exercised in the design of potential overland flood routes and the proximity /levels of dwellings in any low spots. Dwellings should always be slightly elevated in areas considered vulnerable to overland flows, to allow the safe passage of any flows away from the dwelling.

Increased frequency of road gullies in low spots or potential areas of overland flow can provide a more efficient system of drainage and mitigate the risks. These design measures should be considered at detailed engineering design stage.

8.3 **Flooding from Rivers and the sea:** The sites setting within flood zone 1 reflects the low risk from flooding from both Tidal and Fluvial sources. The closest watercourse to the south is well below the site and the nearest river is substantially lower than the site.

8.4 **Flooding from Sewers:** There are no public sewers which could be a source of flooding. The highway drain along Whalley Road is at a lower level than the site so cannot pose a flood risk.

8.5 **Flooding from artificial sources:** There are no major water mains which could provide a flood risk and the site is not affected by reservoirs or canals.

9 SUDS

9.1 Building Regulations (Part H), NPPF, UU and local authority development control policies and Environment Agency advice notes, require the consideration of sustainable drainage techniques for new developments. This existing legislation is to be reinforced by the emerging Flood Water Management Act which will provide a formal structure for the adoption of SuDS drainage and further encourage their use.

9.2 Surface Water drainage should be considered in accordance with a prescribed hierarchy aimed at minimising the impact of development. Surface Water flows should be designed to discharge to:

1. Infiltration based or sustainable drainage systems
2. Watercourses
3. Surface Water Sewers
4. Combined Sewers

Designers should evaluate drainage options in accordance with this hierarchy. Developer's rights to connect surface water into the drainage system under section 106 of the Water act will be withdrawn as part of the new act until it can be proven to the SAB that methods of drainage further up the hierarchy cannot be reasonably achieved.

- 9.3 Guidance on SUDS techniques can be found in the SUDS Manual (Ciria 2007). There are various forms of technique available as summarised below:

Table 3746.8 – Forms of SuDS Drainage

Technique	Description
Trenches	Shallow excavations filled with rubble or stone that create temporary storage and either filter into the ground or convey water to an outlet
Swales	Shallow linear vegetated drain ditches which can either convey flows to an outlet or infiltrate via a granular sub base to the sub strata
Pervious Pavements	Material which allows water to permeate into underlying sub strata – best utilised on flat sites.
Geocellular Systems/Tank systems	Modular plastic geocellular systems which have a high void ratio and allow water to be storage below ground Large diameter pipework or purposes designed tanks to allow below ground storage.
Infiltration Basins	Vegetated depressions which allow water storage and slow infiltration into the ground
Detention Basins	Surface water storage basins which remain dry when not in use and allow flood water to collect and discharge to a design flow rate
Ponds	Ponds can provide both attenuation and treatment features, together with landscape and ecology value. Run off through storms is attenuated in an upper level above ambient pond depths.

- 9.4 The use of SUDS techniques is designed to mitigate the impact of development on receiving watercourses or sewers by mimicking pre development conditions as far as possible. New development should not worsen flooding downstream and should attempt to improve flooding wherever practical, particularly if development on brownfield land is proposed.
- 9.5 Sustainable Drainage can take many forms dependant on site use, ground conditions and topography. In terms of the hierarchy of sustainable options, infiltration based systems should be considered in the first instance i.e. soakaways/infiltration swales/basins etc. The use of infiltration systems will be subject to the infiltration characteristics of the natural ground below the site. In areas with cohesive sub soils it is unlikely that sufficient percolation can be provided to allow the implementation of infiltration techniques. Whilst there has been no intrusive investigation on the development to date, review of BGS geology plans indicates that the eastern half of the site may feature shallow sandstone rock head and the western half of the site may features superficial alluvium deposits (likely clays) over rockhead. Given the above

ground conditions, it is unlikely that infiltration drainage will be useable. Actual ground conditions should be determined by intrusive investigation

- 9.6 Sustainable Drainage in areas of cohesive sub soils can be provided by a range of flow attenuation devices to suit the proposed development, policies of adopting authorities and planning authority requirements. Attenuation ponds and swales can provide ecological benefits by the creation of wetland habitats; however these types of SuDS are more suited to larger developments which have a requirement to meet certain minimum open space standards. In smaller developments the use of ponds or basins can reduce the density of development to below good planning practice and government targets.
- 9.7 Provision of attenuation storage volume by underground tanks or oversize sewers is also an acceptable form of SUDS drainage and in many cases may provide the most practical solution to meet the requirements of guidance due to the availability of land or layout and topographical constraints.

10 PROPOSED DRAINAGE STRATEGY

- 10.1 The development of the site will require a new drainage system designed to suit the final approved layout, and in compliance with current Building Regulations and Sewers for Adoption. The system will be adopted by UU under a section 104 agreement.
- 10.2 ID have not been instructed to undertake a detailed drainage design at this stage, however a strategy can be determined based on the available information and regulator liaison to date.
- 10.3 ID have liaised with UU to ascertain suitable points of discharge and rates for foul and surface water drainage. A summary is provided below:
- 10.4 **Foul Drainage:** Foul water from the development can discharge to the existing foul sewer which passes south of the development. The preferred point of connection is illustrated in the plan within appendix F.

Given the topography of the site and surrounding area a gravity connection is available. It is understood that the provision of the required easements to the sewer is not a problem.

- 10.5 **Surface Water:** In accordance with the requirements contained within Part H of the building regulations, NPPF and the emerging SuDS standards, the surface water strategy should be considered in order of the sustainable hierarchy. The hierarchy and ability of the site to support the particular elements of the hierarchy are discussed below:
- 10.7 **Discharge to infiltration drainage/soakaway:** The ability of any development to discharge to infiltration drainage is wholly reliant on the ground conditions across the site. Anticipated ground conditions are superficial deposits of clay over rockhead in the west, and shallow rockhead in the east. A detailed intrusive ground investigation should be undertaken to determine the actual ground conditions on site.

Sandstone rockhead may be suitable for soakaway design however it is largely dependant on the degree of fracturing in the rock. That majority of sandstones are not suitable for soakaway drainage due to the irregular fracturing. An assessment of this issue should be made during the intrusive investigation phase. For the purposes of this report consideration has been given to the scenario whereby soakaways are not possible.

- 10.8 **Discharge to Watercourse:** The site is not crossed by a watercourse however is approximately 60m from an unnamed tributary of the River Ribble to the south. This watercourse is the preferred outfall for surface water drainage.
- 10.9 **Discharge to Surface Water Sewer:** There are no suitable sewers in the area.
- 10.10 Unrestricted flows from a developed catchment area of 0.95 Ha would typically be around 130 l/s for a 1 in 2 year event and 200 l/s for a 1 in 30 year event. Unrestricted discharges of this magnitude would not be permitted to the watercourse due to the potential implications on the downstream network and increase in flood risk.
- 10.11 NPPF and the Practice guide to PPS25 state that new development should not increase flows above Greenfield pre development levels.
- 10.12 New drainage should be designed to provide attenuation storage to flows in excess of the pre development base flow rate between the 1 in 1 year and 1 in 100 year events. In accordance with Sewers for Adoption, storage capacity should allow for flows from the 1 in 30 year event without flooding. Flood water from the 1 in 100 year event should be assessed and stored safely on the site or as a minimum it should be demonstrated that the excess flow can be safely discharged from site without increasing flood risk elsewhere.
- 10.13 The site should feature a single outfall due to its size, and the outfall rate should be controlled to a maximum of the pre development rate which has been assessed previously as 19.4 l/s.
- 10.14 **Method of Storage:** The proposed options for storage of surface water are constrained by the sites topography, size and layout. Due to the topography and sloping nature of the site a pond would be inefficient. In terms of planning aspects, it is important visually not to develop up to the ridge of the site and therefore the majority of the open space is to the north with a secondary open space centrally around a retained tree. This disbursement of open space is not suited to inclusion of ponds or basins.
- 10.15 The preferred method of storage will be via underground tanks either below the highway network or below the open space adjacent to Whalley Road subject to landscape implications. It may be possible subject to detailed design and the requirements of UU to provide storage in land to the south adjacent to the outfall watercourse. Both options need to be explored and consultations held with the adopting authorities.
- 10.16 Using microdrainge storage estimate the volume required for storage in the 1 in 30 year event is 235m³. The 1 in 100 year event (plus 30% climate change factor) would generate 505m³ which would be required to be stored on the site or within the main storage facility. Due to the sloping nature of the site it is envisaged that the storage will need to be allowed within the tank.
- 10.17 In order to minimise the drained catchment it may be possible to design incidental hard standing areas (small driveways) to discharge to landscape areas which feature a shallow depression to promote groundwater percolation. Care should be exercised to ensure that large catchments discharging to landscape areas do not cause a flood risk as percolations rates are likely to be slow.
- 10.18 Low spots in the site external design levels should be carefully considered to ensure that they are adequately drained or that a flood route or temporary storage is available to prevent a risk to dwellings.

11 IMPACT OF DEVELOPMENT AND RESIDUAL RISK

- 11.1 A detailed Flood Risk Assessment and drainage management plan has been undertaken with respect to the planned development at Whalley Road, Hurst Green. The FRA has been undertaken in accordance with EA, UU and local authority development control guidance, and considers the setting of the development and likely impact on surrounding areas. A drainage strategy has been outlined in the report.
- 11.2 The site has been identified as within flood zone 1, and therefore the flood risk is considered **low** and the form of development is **appropriate** for the site.
- 11.3 Greenfield pre development rates have been assessed and the site can be drained to the watercourse without increasing the existing run off rate.
- 11.4 The assessment has identified the current site drainage characteristics and also established the current level of risk from flooding. A summary of the risks and mitigation identified is presented below:

Table 3746.9 - Summary of Main Issues

Issue	Summary	Residual Risk
Flood zone	Zone 1 (low risk) Development proposed is compatible to the flood setting	Low
Fluvial flooding	Low risk of flooding from Fluvial and Tidal sources	Low
Pluvial flooding	Low risk of pluvial flooding.	Low
Overland Flooding	No significant risk of overland flooding noted.	Low
Artificial Sources	No significant artificial sources known	Low
Flood Mitigation	No specific flood mitigation required for the development other than careful design of any low spots or overland flood routes within the site	Low
Surface Water Management	Maintain pre development Greenfield rates of discharge via on site attenuation. Attenuation to be designed to 1 in 100 year plus climate change standards and restricted to 12.4 l/s Greenfield rate.	Low

- 11.5 On the basis of the above report it is considered that the site can be designed in a safe manner and can contribute to a reduction in the flows within the sewer system.