

320110892P

**WADDOW VIEW
CLITHEROE**

FLOOD RISK ASSESSMENT



For

The Huntroyde Estate
C/o Ingham & Yorke LLP,
Padiham,
Lancashire,
BB12 7QX

August 2011

CHEWS FARM

CLITHEROE

Flood Risk Assessment

October 2011

320110892P

Document Reference: **SEA/07_FRA**

Revision: **Rev 2.0**
Date of Issue: **Oct 2011**
Report Status: **Final**
Issued by: **RN**

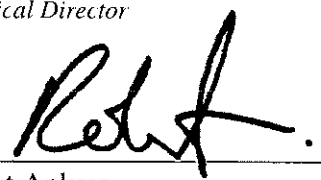
Prepared by:


Richard Nicholas BEng (Hons)
Associate

Checked by:


Martin Pocock BEng (Hons) CEng MICE C WEM MCIWEM
Technical Director

Authorised by:


Robert Ankers
Director

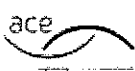
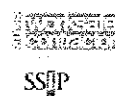
Revision History:

Rev.:
1.0

Date:
August 2011

Status:
Draft

Issued by:
RDN



Old Marer Farm Barns
Llwyn Road, Sealand
Plymouth PL15 2LY
Telephone: 01244 220 170
Fax: 01244 203 515

EXECUTIVE SUMMARY

The Environment Agency Online Flood Maps indicated that the site is located in an area classified as Flood Zone 1 and at low risk of flooding from Fluvial or Tidal sources. PPS 25 confirms that the land use falls into 'more vulnerable' and this is appropriate for Flood Zone 1.

The primary option for surface water disposal is for discharge to the watercourse that runs along the southern boundary. The proposed discharge rate is the Greenfield run-off rate 9.3 l/s (Qbar).

Storm water storage is required to prevent flooding for storm events up to and including the 100 year return period storm event, with a 30% allowance for climate change. The estimated storage volumes for the 30 and 100(+30%CC) year return period storm events are; 87-158 m³ and 192-319 m³ respectively.

In summary, the development can be considered appropriate for Flood Zone 1 in accordance with PPS 25.

CONTENTS

EXECUTIVE SUMMARY	iv
Figures & Tables	6
Abbreviations / Acronyms	6
Specialist Drainage/Flood Risk Management Software	6
1.0 INTRODUCTION	8
2.0 PROPOSED DEVELOPMENT SITE	9
2.1 Site Location and Description	9
2.2 Site Levels	9
2.3 Development Proposals	10
3.0 FLOOD RISK ASSESSMENT	11
3.1 Environment Agency Information on Flood Risk	11
3.2 Strategic Flood Risk Assessment (SFRA) Information	12
3.3 Anecdotal Flooding Information	12
3.4 Watercourses	12
3.5 Sewer Flooding	13
3.6 Overland Flooding	13
3.7 Groundwater Flooding	14
3.8 Flood Risk Vulnerability and Flood Zone Compatibility	14
4.0 SURFACE WATER MANAGEMENT	15
4.1 Impermeable Area and Surface Water Run-off	15
4.2 Sustainable Drainage Systems (SuDS)	15
4.3 Methods of Surface Water Management	16
4.4 Infiltration	16
4.5 Discharge to a Watercourse	16
4.6 Discharge to a Public Sewer	17
4.7 Foul Water Management	17
4.8 Climate Change	18
4.9 Residual Risks	18
5.0 SUMMARY AND CONCLUSIONS	19
BIBLIOGRAPHY & REFERENCES	20
Appendix A: Location Plan	22
Appendix B: Planning Layout Drawing	24
Appendix C: Topographical Survey	26
Appendix D: Environment Agency Flooding Information	28
Appendix E: United Utilities Sewer Records Extract	30
Appendix F: PPS 25 Extracts (Tables D.2. and D.3.)	32
Appendix G: Surface Water Run-off Calculations	34
Appendix H: WinDES Quick Storage Estimate	36
Appendix I: Photographs	38
Appendix J: Notes of Limitation	40

Figures & Tables

Figure 1: Photograph of site	10
Figure 2: EA Flood Zone Map Extract (2011)	11
Figure 3: Photograph of outfall	13
Figure 4: UUW Sewer Records Extract	17

Abbreviations / Acronyms

BGL	Below Ground Level
CC	Climate Change
CDA	Critical Drainage Area
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
Ha	Hectare
FZ	Flood Zone
LPA	Local Planning Authority
mAOD	Metres Above Ordnance Datum
PPS25	Planning Policy Statement: 25
QSE	Quick Storage Estimate (WinDES)
ReFEH	Revitalised FSR/FEH Rainfall Run-off Method
RVBC	Ribble Valley Borough Council
SuDS	Sustainable Urban Drainage Systems
TWL	Top Water Level
UKCIP	UK Climate Impacts Programme
UUW	United Utilities Water

Specialist Drainage/Flood

Risk Management Software

- WinDES by MicroDrainage v12.6 – Quick Storage Estimates (QSE)
- Flood Estimation Handbook (FEH) CD-ROM v.3.0– Rainfall generation and Catchment Data

320110892P

1.0 INTRODUCTION

- 1.1 Government policy with respect to development in flood risk areas is contained within the Department of Communities and Local Government Planning Policy Statement 25 (PPS25) 'Development and Flood Risk' which was issued on 07 December 2006.
- 1.2 PPS 25 builds on the previous guidance contained in the Planning Policy Guidance Note 25 (PPG 25) 'Development and Flood Risk' which was issued on 17 July 2001.
- 1.3 This report was commissioned by the client to support a planning application for the construction of a residential development of approximately 45 units complete with estate roads, external works, footpaths, car parking, external lighting, landscaping, boundary walls, fencing, external services and drainage.
- 1.4 The Local Planning Authority (LPA), Ribble Valley Borough Council (RVBC), will make the final decision with regard to any planning permission. PPS 25 advises that a local planning authority should consult with the Environment Agency (EA) who are a statutory consultee and provide advice on flood issues at a strategic level and in relation to planning applications.

2.0 PROPOSED DEVELOPMENT SITE

2.1 Site Location and Description

- 2.1.1 The site is located just off Milton Avenue, Clitheroe. The National Grid Reference for the site is 374096 E, 442181 N. The site location plan is shown in Appendix A. The site covers approximately 1.23 hectares (Ha).
- 2.1.2 The site is accessed via Milton Avenue which runs along the northern site boundary. It is currently an open grassed field with a public footpath along the northern site border. The site is generally square, levels slope gently from northwest to southeast. Existing mature trees line the eastern site border, and hedgerows line the northern, southern and western borders.
- 2.1.3 There is an existing derelict building immediately beyond the northwest corner of site. Surrounding area is predominantly residential to the north and south, fields to the west and a public car park to the east. A small stream was noted approximately 40m southwest of the site emerging from a culvert and running north-northeast. A railway line is shown 100m south of site.
- 2.1.4 Historic maps suggest a watercourse that flowed along the eastern boundary, then the southern boundary before heading offsite in a west/northwest direction; however there was no evidence of a watercourse above ground along the eastern boundary. The watercourse is understood to still run below ground (culverted) along the southern boundary.

2.2 Site Levels

- 2.2.1 The site is reasonably level with no significant levels features and no major boundary level issues. The site generally falls to the southern boundary with a high point on site to the northern corner. The recent residential development to the south is elevated by comparison to the site.

2.3 Development Proposals

- 2.3.1 The proposed development consists of the construction of a residential development of approximately 50 units complete with estate roads, external works, footpaths, car parking, external lighting, landscaping, boundary walls, fencing, external services and drainage. A recent photograph is shown in Figure 1.

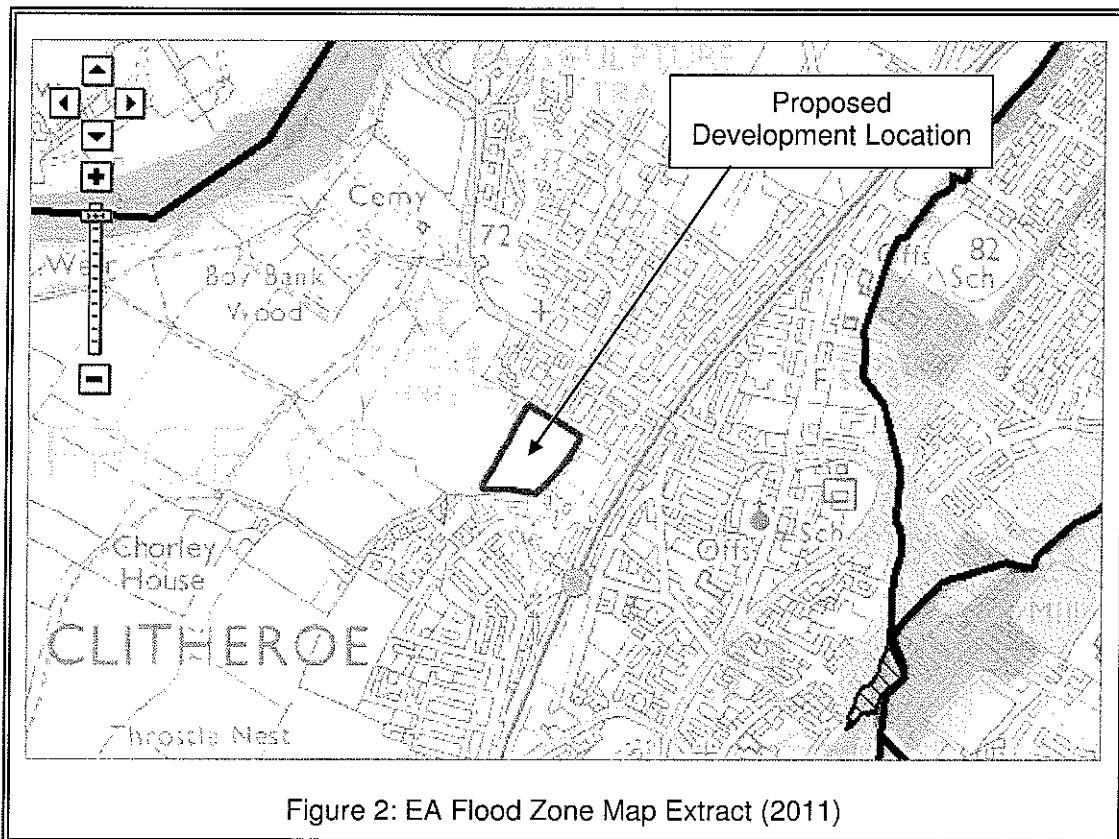


Figure 1: Photograph of site
View east from the middle of site

3.0 FLOOD RISK ASSESSMENT

3.1 Environment Agency Information on Flood Risk

- 3.1.1 Information relating to the flood risk at the site has been obtained from the Environment Agency's (EA) website and online Flood Map, an extract of which is shown in figure 2 (below).
- 3.1.2 Examination of the Flood Map shows that the site is located wholly within Flood Zone 1. This is based on the EA Flood Map and is classified Flood Zone 1 with regards to the risk of flooding from Rivers or the Sea; Appendix B shows the online flood map and statement in full.



3.2 Strategic Flood Risk Assessment (SFRA) Information

- 3.2.1 The SFRA also indicates that the overall site is not located within functional flood plain and there are no specific risks to the site area indicated within the SFRA.

3.3 Anecdotal Flooding Information

- 3.3.1 An Internet based search for flooding events did not recall any historical flooding in the immediate site area.

3.4 Watercourses

- 3.4.1 Historic maps suggest a watercourse that flowed along the eastern boundary, then the southern boundary before heading offsite in a west/northwest direction; however there was no evidence of a watercourse above ground along the eastern boundary. The watercourse is understood to still run below ground (culverted) along the southern boundary.
- 3.4.2 The watercourse appears to be fed by a public surface water sewer (UUW asset) at UUW node ref. 1104 (900mm dia. pipe).
- 3.4.3 The culvert (c.900mm dia.) discharges in to an open channel a distance of approximately 40m to the southwest of the western corner of the development area. A photograph of the outfall is shown in figure 3.
- 3.4.4 The culvert is thought to be located around the southern site boundary although its exact location needs to be confirmed (sonar trace or similar). The outfall is located offsite under adjacent residential development.
- 3.4.5 The land through which the downstream open channel watercourse flows is also owned by the land owner of the development area.



Figure 3: Photograph of outfall
View east at the outfall headwall location southwest of the development

3.5 Sewer Flooding

- 3.5.1 There are no known sewer capacity issues with the surface water system in the immediate vicinity that have given rise to flooding issues.
- 3.5.2 No specific flood risk issues from the public sewer network have been identified. It was intimated by UUW that the most likely source of flood risk from the sewer network was surcharging of the sewer system in periods of intense rainfall.
- 3.5.3 In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and waste water known as "combined sewers". Foul water flooding often occurs in areas prone to overland flow and can result when the sewer is overwhelmed by heavy rainfall and will continue until the water drains away. It can also occur when the sewer becomes blocked or is of inadequate capacity, this could lead to there being a high risk of internal property flooding with contaminated water.

3.6 Overland Flooding

- 3.6.1 Intense rainfall, that is unable to soak into the ground or enter drainage systems can run-off land and result in flooding. Local topography and the land use can have a strong influence on the direction and depth of flow. Large catchment areas are particularly prone to this type of flooding. The volume and rate of overland flow from land can be exacerbated if development increases the percentage of impermeable area.

- 3.6.2 The topography of the development and surrounding area means there is little likelihood of significant flows impacting on the proposed development or on land and property adjacent to the development. The only flows that are likely to be present on site are from direct rainfall on areas of hardstanding.
- 3.6.3 Any flows generated by the proposed development must be directed away from the adjacent existing residential properties on the western boundary; safe avenues of overland flow away from the proposed dwellings are advised.

3.7 Groundwater Flooding

- 3.7.1 In general terms groundwater flooding can occur from three main sources: - raised water tables, seepage and percolation and groundwater recovery or rebound.
- 3.7.2 Raised water tables – at the current time there are no reported problems associated with rainfall raising the local water table and flooding occurring.
- 3.7.3 Seepage and percolation – Seepage and percolation occur where embankments above ground level hold water. In these cases water travels through the embankment material and emerges on the opposite side of the embankment. Due to the distance of the proposed development area relative to any watercourse the likelihood of flooding from this source is low.
- 3.7.4 Groundwater recovery / rebound – occurs where the water table has been artificially depressed by abstraction. When the abstraction stops the water table makes a recovery to its original level. There is the potential for groundwater flooding in low lying areas where groundwater levels have been depressed below their pre-pumping conditions, where these were at or close to ground level. As with the seepage scenario the likelihood of flooding from this source is low.

3.8 Flood Risk Vulnerability and Flood Zone Compatibility

- 3.8.1 The development is classified as a residential development and as such 'more vulnerable' in Table D.2 of PPS 25. Table D.3 in PPS 25 confirms that this type of land use is appropriate for Flood Zone 1 (see Appendix H for tables).

4.0 SURFACE WATER MANAGEMENT

4.1 Impermeable Area and Surface Water Run-off

- 4.1.1 The total site area of 1.23 hectares currently consists of 100% pervious area
- 4.1.2 The existing permeable area (Greenfield) generates a run-off rate of approximately 9.3 l/s based on the IH124 / ICP-SUDS methodology.
- 4.1.3 The proposed development will increase the impermeable area of the development to approximately 40% of the total site area (0.44 Ha).
- 4.1.4 The proposed impermeable area generates a run-off rate of 61.1 l/s based on a rainfall of 50mm/hr.
- 4.1.5 It is proposed that the development be restricted to the pre-development Greenfield run-off rate QBar 9.3 l/s.
- 4.1.6 The resultant storage volume generated by the restricted outfall needs to cater for rainfall events up to and including the 100 year return period storm event (plus 30% allowance for Climate Change). The main surface water system being offered for adoption (UU) is likely to be sized to suit a 30 year return period storm event with volumes greater than this being contained within the public highway or an area designated public open space for a brief period of time for the 100 year extreme rainfall event (plus 30% allowance for Climate Change). This is an accepted method of dealing with the extreme rainfall event provided depths of resulting storage are shown to be minimal
- 4.1.7 The site would have historically drained to the watercourse on the southern boundary that would have historically been an open channel.

4.2 Sustainable Drainage Systems (SuDS)

- 4.2.1 In accordance with PPS25, Sustainable Drainage Systems (SuDS) should be specified wherever possible to manage surface water. This in turn reduces the burden downstream on both watercourses and sewerage systems.
- 4.2.2 SuDS have the ability to address three core objectives; water quantity, water quality and amenity value. With the appropriate system specified, all three core objectives can be satisfied. Where possible, peak surface water discharge rates to watercourses and sewers should be reduced.
- 4.2.3 Preference should always be given to SuDS over the traditional methods of buried sewers wherever possible and practical. Runoff from car parking areas and roads could be conveyed through swales, permeable pavements, bio-retention areas and petrol interceptors to provide a degree of treatment before flows are carried to public sewers.
- 4.2.4 Opportunities should be taken to provide soft landscaping where at all possible on site to assist in minimising surface water run-off. Added benefits include biodiversity and visual enhancements.

4.2.5 The exact type of SuDS will be determined at the detailed design stage.

4.3 Methods of Surface Water Management

4.3.1 At present the site is developed and is being treated as Greenfield. There is approximately 1.23 hectares of existing pervious area, 100% of the total site area.

4.3.2 The proposed impermeable area of the development is approximately 0.440 hectares, 40% of the total site area.

4.3.3 There are three methods that have been reviewed for the management and discharge of surface water detailed below; these may be applied individually or collectively to form a complete strategy. They should be applied in the order of priority listed below.

- Infiltration/soakaway
- Discharge to watercourse
- Discharge to public sewerage system

4.4 Infiltration

4.4.1 Ground conditions are expected to be of a cohesive nature and are unlikely to be favourable, with little to no infiltration expected. As a result surface water discharge via soakaways is not likely to be feasible, however until soakaway testing to BRE365 is undertaken to confirm the infiltration characteristics of the ground this should not be discount as a part or total solution for surface water management.

4.5 Discharge to a Watercourse

4.5.1 A connection to the watercourse is ideal for managing the surface water flows generated by the proposed development. The watercourse should be of sufficient depth to allow a suitable outfall with the necessary cover to any attenuation system. In addition the open channel watercourse that is located outside of the development area is within the ownership of the developer so there should be no third party connection issues.

4.5.2 As an increase in the impermeable area is proposed by approximately 40% (as the site is currently Greenfield) there will be an increase in the resultant volume of surface water run-off being generated compared to the pre-development scenario. This increase in surface water volume means that a discharge rate of Q_{bar} should be applied to the surface water flows.

4.5.3 As a connection is proposed to a watercourse it is an EA requirement that the surface water drainage proposals cater for the 100 year return period storm event with a 30% allowance for climate change.

4.5.4 The main surface water system being offered for adoption (UU) is likely to be sized to suit a 30 year return period storm event with surface water volumes arising from storm events greater than this being contained within the public highway or an area of designated public open space for a brief period of time for the 100 year extreme rainfall event (plus

30% allowance for Climate Change). This is an accepted method of dealing with the extreme rainfall event provided depths of resulting storage are shown to be minimal.

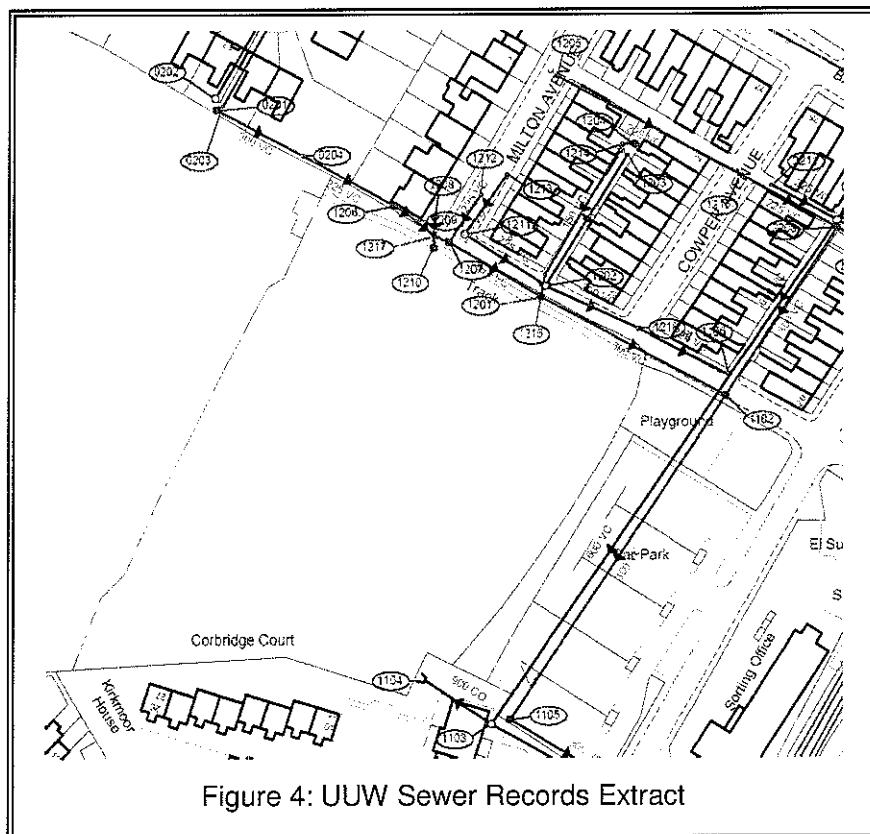
- 4.5.5 The estimated storage volumes for the 30 and 100(+30%CC) year return period storm events are; 87-158 m³ and 192-319 m³ respectively.

4.6 Discharge to a Public Sewer

- 4.6.1 United Utilities Water will not allow connection to the public surface water sewer in light of the watercourse being in close proximity to the development unless a connection is determined to be unfeasible due to practical constraints such as levels etc.

4.7 Foul Water Management

- 4.7.1 A foul water connection to the combined public sewer located in Milton Avenue is proposed for the flows generated by the development. The flows are estimated at 2.3l/s based on 4000 litres/dwelling/24hrs.
- 4.7.2 Confirmation that this connection is feasible needs to be determined from a ground level and invert level perspective.



4.8 Climate Change

- 4.8.1 There are indications that the climate in the UK is changing significantly and it is widely believed that the nature of climate change will vary greatly by region. Current expert opinion indicates the likelihood that future climate change would produce more frequent short duration and high intensity rainfall events with the addition of more frequent periods of long duration rainfall.
- 4.8.2 PPS25 table B.2 states that the recommended national precautionary sensitivity ranges for increase of peak rainfall intensity is 30% until 2115. It is widely believed that the impact of climate change means there is likely to be a long term increase in the average sea levels, with an expectation that sea levels will rise gradually.
- 4.8.3 An increase in flood water levels means that future flooding events will occur more frequently and will have a greater impact.
- 4.8.4 Any increase in the level of flood risk to the proposed development from climate change is likely to be related to the increase in rainfall intensity and duration and its impact upon the surface water drainage system.

4.9 Residual Risks

- 4.9.1 The development is accessible for emergency access and egress during times of extreme flooding as the flood plain does not extend into the area proposed for residential development.

5.0 SUMMARY AND CONCLUSIONS

- 5.0.1 The Environment Agency Online Flood Maps indicated that the site is located in an area classified as Flood Zone 1 and at low risk of flooding from Fluvial or Tidal sources.
- 5.0.2 The site falls within Flood Zone 1 PPS 25 confirms that the land use falls into 'more vulnerable' and this is appropriate for Flood Zone 1.
- 5.0.3 The primary option for surface water disposal is for discharge to the watercourse that runs along the southern boundary.
- 5.0.4 The proposed discharge rate is the Greenfield run-off rate 9.3 l/s (Qbar).
- 5.0.5 Storm water storage is required to prevent flooding for storm events up to and including the 100 year return period storm event, with a 30% allowance for climate change.
- 5.0.6 The estimated storage volumes for the 30 and 100(+30%CC) year return period storm events are; 87-158 m³ and 192-319 m³ respectively.
- 5.0.7 In summary, the development can be considered appropriate for Flood Zone 1 in accordance with PPS 25.

BIBLIOGRAPHY & REFERENCES

CIRIA 522, Sustainable urban drainage systems – Design manual for England and Wales, (2000)
CIRIA 523, Sustainable urban drainage systems – Best practice manual, (2001)
CIRIA 624, Development and Flood Risk – Guidance for the construction industry, (2004)
CIRIA 635, Designing for Exceedance in Urban drainage – Good practice, (2006)
CIRIA 697, The SUDS Manual
Civils Contingency Act (2004)
Defra Research Paper FD2321 (Flood Risk to People), DEFRA & Environment Agency (2005)
Flood Estimation Handbook (FEH), (1999)
Flood Studies Report (FSR), (1975)
Planning Policy Statement 25: Development and Flood Risk (PPS 25), (2006)
Ribble Valley Borough Council – Strategic Flood Risk Assessment Level One (May 2010)

Drawing references

Planning Layout – (MCK Associates Ltd)

Web-based references

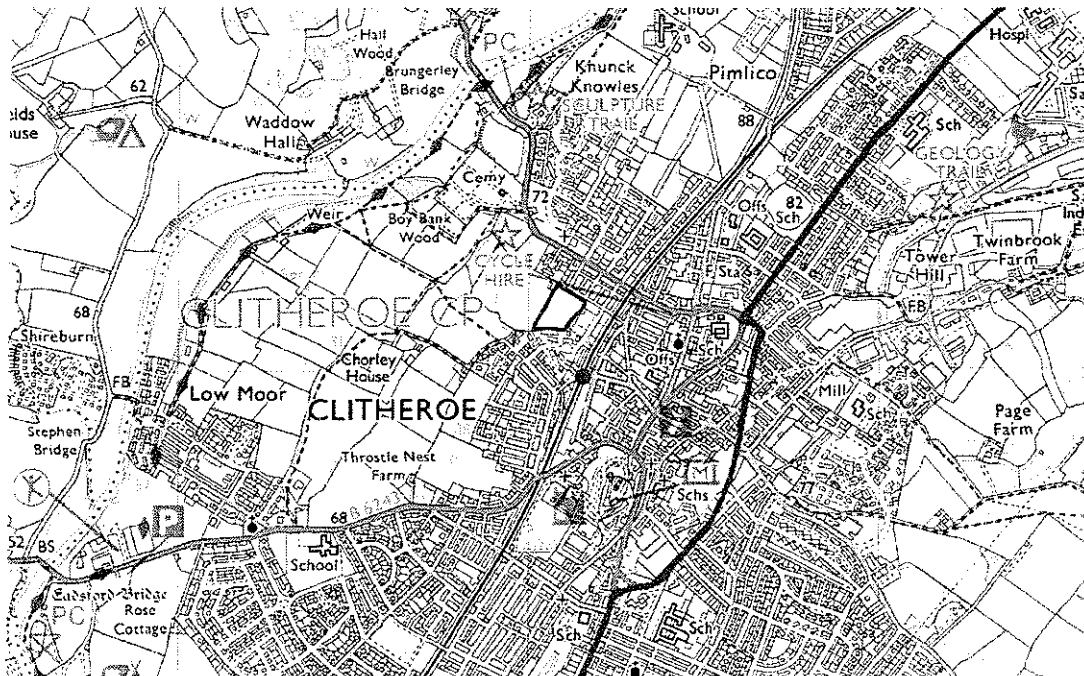
Bingmaps – <http://www.bing.com/Maps/>
British Geological Survey – <http://www.bgs.ac.uk/opengeoscience/home.html>
Chronology of British Hydrological Events – www.dundee.ac.uk/
CIRIA – <http://www.ciria.org/>
Cranfield University – <http://www.landis.org.uk/soilscapes/>
Environment Agency – www.environment-agency.gov.uk/
FloodProBE – <http://www.floodprobe.eu/>
Flood Forum – <http://www.floodforum.org.uk/>
Flood London – <http://www.floodlondon.com/>
Flood Resilience Group – <http://www.floodresiliencegroup.org/frg/>
Google Maps – <http://maps.google.co.uk/>
London Resilience – <http://www.londonprepared.gov.uk/>
Ribble Valley Borough Council – <http://www.ribblevalley.gov.uk/>
Streetmap – <http://www.streetmap.co.uk/>
United Utilities – <http://www.unitedutilities.com/>
US Army Corps of Engineers – <http://www.hec.usace.army.mil/software/hecras/>
Watertight International – <http://www.watertightinternational.com/>

Appendix A: Location Plan

This page has been left intentionally blank

320110892P

LOCATION PLAN
CHEWS FARM, MILTON AVENUE, CLITHEROE



OS X (Eastings)	374096
OS Y (Northings)	442181
Nearest Post Code	BB7 2HX
Lat (WGS84)	N53:52:31 (53.875177)
Long (WGS84)	W2:23:44 (-2.395478)
IR	SD740421
mX	-266663
mY	7112013

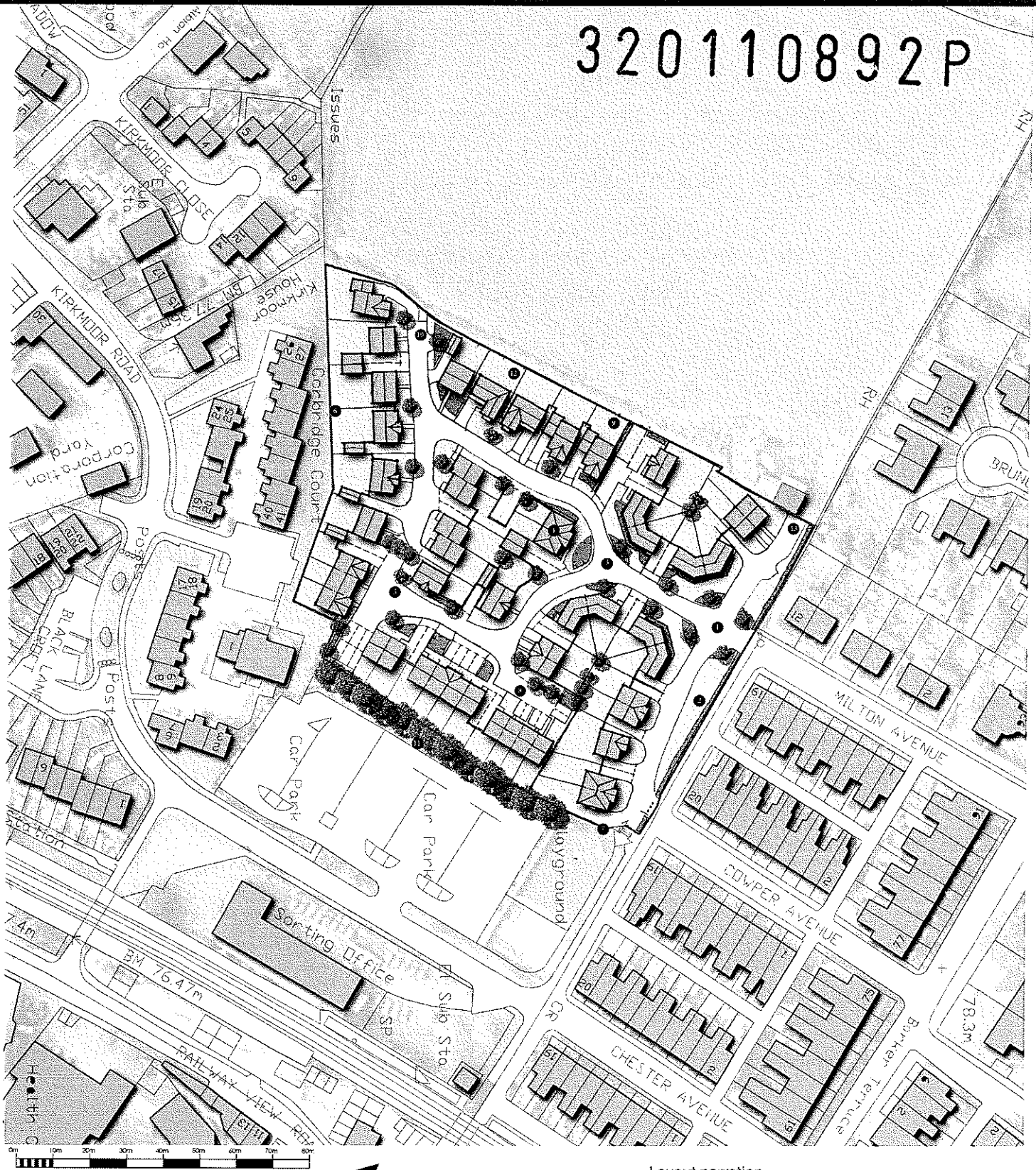
Appendix B: Planning Layout Drawing

320110892P

This page has been left intentionally blank

Waddow View Clitheroe

320110892P



Abstracts and Indexing



Priznanje Vrhovne



Potamogeton nodosus (L.) Rostk.

1. **Identify** the **main** **topic** of the text. What is the **main** **idea** of the text? What is the **main** **point** of the text?
2. **Underline** the **main** **topic** of the text. What is the **main** **idea** of the text? What is the **main** **point** of the text?
3. **Underline** the **main** **topic** of the text. What is the **main** **idea** of the text? What is the **main** **point** of the text?
4. **Underline** the **main** **topic** of the text. What is the **main** **idea** of the text? What is the **main** **point** of the text?
5. **Underline** the **main** **topic** of the text. What is the **main** **idea** of the text? What is the **main** **point** of the text?
6. **Underline** the **main** **topic** of the text. What is the **main** **idea** of the text? What is the **main** **point** of the text?
7. **Underline** the **main** **topic** of the text. What is the **main** **idea** of the text? What is the **main** **point** of the text?

1. Welche Aufgaben haben die folgenden Bauteile?
 - Zylinderkopf: schließt das Zylinderinnere nach oben ab und überträgt den Pleuellagerdruck auf die Pleuellagerbolzen.
 - Pleuellagerbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzenbolzen.
 - Pleuellagerbolzenbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzen.
 - Pleuellagerbolzenbolzenbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzenbolzen.
2. Welche Aufgaben haben die folgenden Bauteile?
 - Pleuellagerbolzenbolzenbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzenbolzenbolzen.
 - Pleuellagerbolzenbolzenbolzenbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzenbolzenbolzenbolzen.
3. Welche Aufgaben haben die folgenden Bauteile?
 - Pleuellagerbolzenbolzenbolzenbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzenbolzenbolzenbolzen.
 - Pleuellagerbolzenbolzenbolzenbolzenbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzenbolzenbolzenbolzenbolzen.
4. Welche Aufgaben haben die folgenden Bauteile?
 - Pleuellagerbolzenbolzenbolzenbolzenbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzenbolzenbolzenbolzenbolzen.
 - Pleuellagerbolzenbolzenbolzenbolzenbolzenbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzenbolzenbolzenbolzenbolzenbolzen.
5. Welche Aufgaben haben die folgenden Bauteile?
 - Pleuellagerbolzenbolzenbolzenbolzenbolzenbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzenbolzenbolzenbolzenbolzenbolzen.
 - Pleuellagerbolzenbolzenbolzenbolzenbolzenbolzenbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzenbolzenbolzenbolzenbolzenbolzenbolzen.
6. Welche Aufgaben haben die folgenden Bauteile?
 - Pleuellagerbolzenbolzenbolzenbolzenbolzenbolzenbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzenbolzenbolzenbolzenbolzenbolzenbolzen.
 - Pleuellagerbolzenbolzenbolzenbolzenbolzenbolzenbolzenbolzen: verbinden das Pleuellager mit dem Pleuellagerbolzenbolzenbolzenbolzenbolzenbolzenbolzenbolzen.

Appendix C: Topographical Survey

This page has been left intentionally blank

320110892P

Client:
Huntroyd Estate

Project:
Waddow View
Clitheroe

Drawing Title:
Site Location Plan

Job No:
11-021

Drawing No:
11-021-01

Rev:

Drawn:

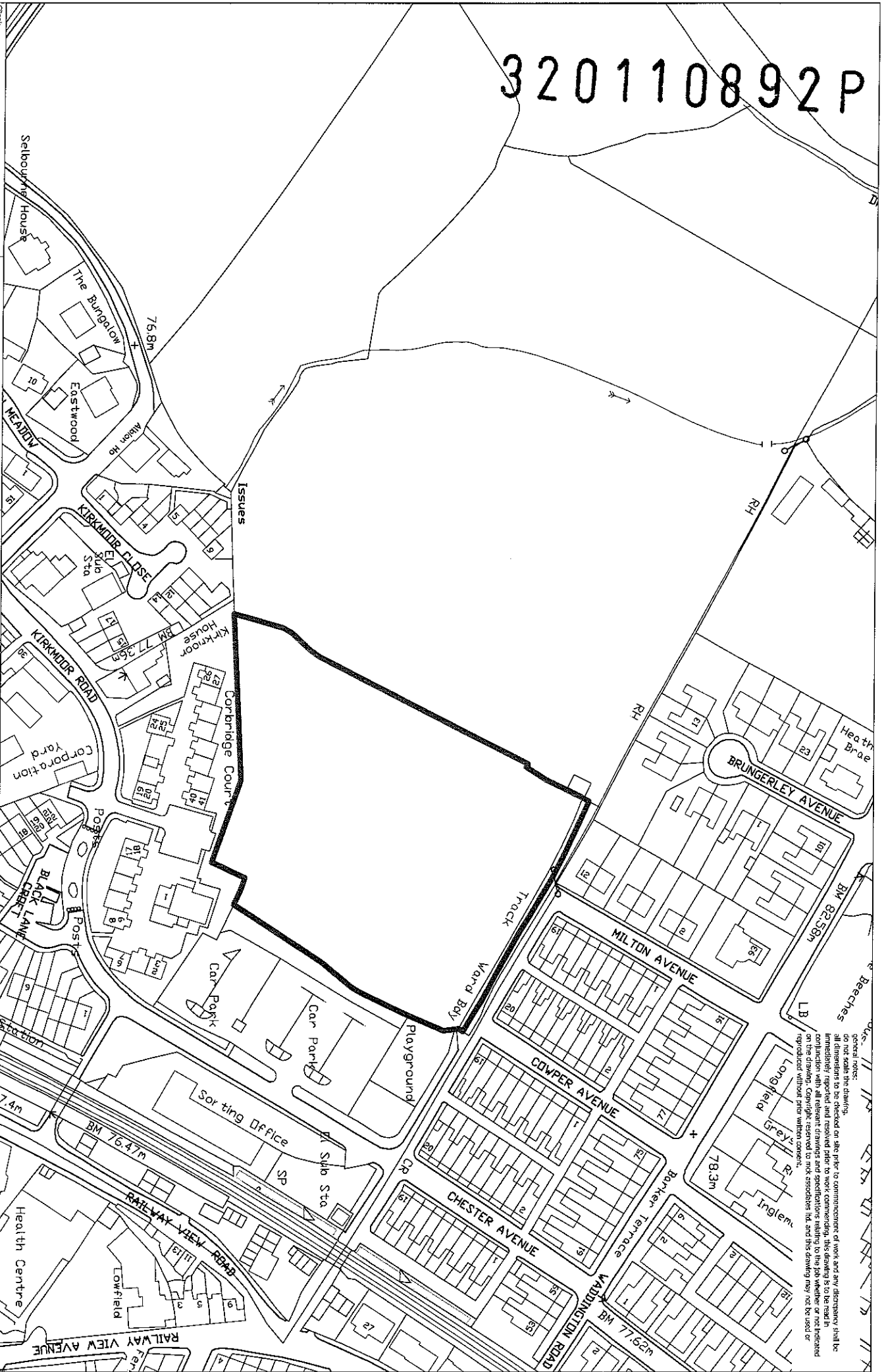
Checked:

Scale:
1:1250 @ A3

Date:
April 2011

mck associates limited
architects • building surveying • project management

burnaby villa • 48 waddington road • fulwood • Preston • PR2 8BP
tel: 01772 774510 fax: 01772 774511 mol@mckassociates.co.uk



general notes:
do not scale the drawing
this drawing is prepared on the basis of information supplied by the client and is not to be used for any other purpose without the written consent of the architect.
the architect shall be responsible for the accuracy of the information supplied and shall not be liable for any loss or damage arising from its use.
this drawing is the property of the architect and shall remain their property whether or not it is used for the purpose for which it was prepared.
reproduced without prior written consent.

Appendix D: Environment Agency Flooding Information

This page has been left intentionally blank

320110892P

Cymraeg About us Jobs Contact us Sitemap Help | Search



GO

Enter a postcode or place name:

Other topics for this area...

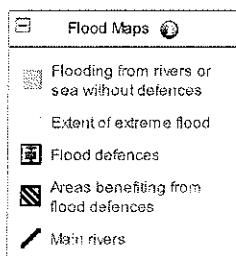
Risk of Flooding from Rivers and Sea

BB7 2HX



Risk of Flooding from Rivers and Sea

Map legend



BB7 2HX at scale 1:10 000

[Text only version](#)



© Environment Agency copyright and database rights 2011.
© Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380
contains Royal Mail data © Royal Mail copyright and database right 2011

Flood Map – Information Warnings

Manchester Ship Canal

Flood Mapping of the Manchester Ship Canal in Trafford, Salford and Warrington may be subject to revision as a result of representations. For further information please contact the Environment Agency on 03708 506 506.

Users of the Flood Zone Map should be aware that we have received a Judicial review challenge to the mapping of the Manchester Ship Canal at Trafford, Salford and Warrington on the ground that the preparation of the map is flawed in respect of our consideration of the role of the sluice gates in preventing flooding.

We are defending the challenge and believe and are advised that it is ill-founded. Nevertheless, pending determination of the challenge, users of the map need to consider whether the existence of the Challenge, and the basis of it, affects the weight they judge may be given to the zoning of the Manchester Ship Canal within the Flood Map.

More about flooding:

Understanding the flood map

A more detailed explanation to help you understand the flood map shown above

Current flood warnings

We provide flood warnings online 24 hours a day. Find out the current flood warning status in your local area.

Flood map - your questions answered



Interactive Maps

Flood Risk for X:374100, Y:442168

Be prepared

We do not have an assessment of flood risk for the area which you have selected. This may be because the area selected is outside the floodplain. It could also be because we have been unable to assess the likelihood of flooding for this area because we did not have sufficient information (this applies to fewer than 1% of the properties in England and Wales in the flood outline)

For a fuller explanation of flood likelihood [click here](#)

Be aware:

Our maps only cover flooding from rivers and the sea. Flooding can occur at any time and in any place from sources such as rising ground water levels, burst water mains, road drains, run-off from hillsides, sewer overflows etc.

[Click here to find out more.](#)

To find out how to be prepared for all types of flooding go to our [Floodline](#) pages or call Floodline on tel: 0845 988 1188.

The information on the likelihood of flooding is not intended to be used by people applying for planning permission for new developments. To find out how the Flood Map can help when planning a new development [click here](#)

creating a better place

Follow us: [YouTube](#) [Twitter](#) [Flickr](#) [Facebook](#) [RSS feeds](#)

Author: The Environment Agency | [FOI BY SUPPORT](#) [environment-agency.gov.uk](#)
Last updated: 30th July 2011

[Privacy policy](#) | [Terms and conditions](#) | [Accessibility](#) | [About us](#) | [Jobs](#) | [Contact us](#) | [Sitemap](#) [Help](#)
© Environment Agency 2011

320110892P

Appendix E: United Utilities Sewer Records Extract

This page has been left intentionally blank

Appendix F: PPS 25 Extracts (Tables D.2. and D.3.)

This page has been left intentionally blank

Table D 2: Flood Risk Vulnerability Classification

Essential Infrastructure	- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. - Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. - Wind turbines.
Highly Vulnerable	- Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. - Emergency dispersal points. - Basement dwellings. - Caravans, mobile homes and park homes intended for permanent residential use. - Installations requiring hazardous substances consent.³⁰ (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure'.³¹)
More Vulnerable	- Hospitals. - Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. - Buildings used for dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. - Non-residential uses for health services, nurseries and educational establishments. - Landfill and sites used for waste management facilities for hazardous waste.³¹ - Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Table D 3²³: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see Table D.1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	X	Exception Test required	✓
	Zone 3b (Functions Flood plain)	Exception Test required	✓	X	X	X

Key:

✓ Development appropriate

X Development should not be permitted

Appendix G: Surface Water Run-off Calculations

This page has been left intentionally blank

320110892P

Betts Associates Ltd		Page 1
Old Marsh Farm Barns Welsh Road Sealand Flintshire CH5 2LY	CHEWS FARM MILION AVENUE, CLIIHEROE N. STARKIE	
Date 30.08.2011 File	Designed by RN Checked by	
CADS	Source Control W.12.6	

IH 124 Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	1.100	Urban	0.000
SAAR (mm)	1222	Region Number	Region 10

Results l/s

QBAR Rural	14.1
QBAR Urban	14.1
Q1 year	12.3
Q1 year	12.3
Q2 years	13.1
Q5 years	16.8
Q10 years	19.5
Q20 years	22.2
Q25 years	23.1
Q30 years	23.9
Q50 years	26.1
Q100 years	29.4
Q200 years	33.3
Q250 years	34.6
Q1000 years	42.9

Warning: It is unusual to use the IH124 method with an area < 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required area. The ICP SUDS tab will do this automatically.

©1982-2011 Micro Drainage Ltd

320110892P

Betts Associates Ltd		Page 1
Old Marsh Farm Barns	CHEWS FARM	
Welsh Road Sealand	MILTON AVENUE, CLIIHEROE	
Flintshire CH5 2LY	N. SIARKIE	
Date 30.08.2011	Designed by RN	
File	Checked by	
CADS	Source Control W.12.6	
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 1 Soil 0.450 Area (ha) 1.100 Urban 0.000 SAAR (mm) 1222 Region Number Region 10 Results l/s QBAR Rural 9.3 QBAR Urban 9.3 Q1 year 8.1 Q1 year 8.1 Q30 years 15.7 Q100 years 19.3		
©1982-2011 Micro Drainage Ltd		

320110892P



GREENFIELD RUN-OFF CALCULATION SHEET

Job No	SEA/07	Designed	RDN	Sheet No	1
Project	Chews Farm, Clitheroe	Checked	RA	Date	30.08.2011

Estimation of peak greenfield run-off volumes

Greenfield run-off volumes are calculated to determine the approximate existing maximum volume of surface water that is likely to be discharged pre-development.

Catchment Descriptors	Storm (1:Xyrs) Rainfall depths (mm)
Area (ha) 1.100	Qbar 26.4
SPR (%) 30.40	1 15.5
SAAR (mm) 1222	30 57.0
CWI 125	100 77.8
	100 (+30%) 101.1

Run-off Volume, Vol_x

Return Period (1:Xyrs)	Percentage Run-off (%)				Area (m ²)	Rainfall Depth, P ** (mm)	Volume (m ³)
	SPR	DPR _{CWI}	DPR _{RAIN}	PR _{TOTAL}			
QBAR*	30.40	0.000	0.000	30.400	11000	26.4	88.3
1	30.40	0.000	0.000	30.400	11000	15.5	51.8
30	30.40	0.000	3.270	33.670	11000	57.0	211.1
100	30.40	0.000	5.721	36.121	11000	77.8	309.1
100 (+30%)	30.40	0.000	8.006	38.406	11000	101.1	427.1

* Estimated using the 1:2yr rainfall event

** Rainfall based on the 6hr duration winter profile storm

320110892P



PROPOSED RUN-OFF CALCULATION SHEET

Job No	SEA/07	Designed	RDN	Sheet No	2
Project	Chews Farm, Clitheroe	Checked	RA	Date	30.08.2011

Estimation of post-development run-off volumes

Proposed run-off volumes are calculated to draw a comparison between the existing and proposed maximum volume of surface water that is likely to be discharged.

Catchment Descriptors	Storm (1:Xyrs) Rainfall depths (mm)
Imp. area (ha) 0.440	Qbar 26.4
	1 15.5
	30 57.0
	100 77.8
	100 (+30%) 101.1

Run-off Volume, Vol_x

Return Period (1:Xyrs)	Area (m ²)	Rainfall Depth P ** (mm)	Volume (m ³)
QBAR*	4400	26.4	116.2
1	4400	15.5	68.2
30	4400	57.0	250.8
100	4400	77.8	342.3
100 (+30%)	4400	101.1	444.8

* Estimated using the 1:2yr rainfall event

** Rainfall based on the 6hr duration winter profile storm

320110892P



LONG-TERM STORAGE VOLUME CALCULATION SHEET

Job No	SEA/07	Designed	RDN	Sheet No	3
Project	Chews Farm, Clitheroe	Checked	RA	Date	30.08.2011

Estimation of long term storage volume

The proposed long-term storage volume is calculated to determine the approximate requirements for the storage of flood water for the large storm events.

Catchment Descriptors	Storm (1:Xyrs) Rainfall depth, P (mm)
Area (ha) 1.100	100 (+30%) 101.1
Imp. Area (ha) 0.44	
PIMP 40.00	
SPR 30.4	

Long-term storage volume, Vol_{xs}

Volume Vol_{xs} = Rainfall depth, P x Imp Area x 10 (0.8 x PIMP/100 - SPR)

Vol _{xs} = 7.1174 m ³

Appendix H: WinDES Quick Storage Estimate

This page has been left intentionally blank

320110892P

Micro Drainage		Variables	
		FSR Rainfall	v
		Return Period (years)	30
		Region	England and Wales v
		Map	M5-60 (mm) 20 200
			Ratio R 0.262
Variables		Cv (Summer)	0.750
Results		Cv (Winter)	0.840
Design		Impermeable Area (ha)	0.440
Overview 2D		Maximum Allowable Discharge (l/s)	93
Overview 3D		Infiltration Coefficient (m/hr)	0.00000 v
Vt		Safety Factor	2.0
		Climate Change (%)	0

Micro Drainage		Results	
		Global Variables require approximate storage of between 87 m³ and 158 m³. These values are estimates only and should not be used for design purposes.	
Variables			
Results			
Design			
Overview 2D			
Overview 3D			
Vt			

320110892P

Variables	
FSR Rainfall	Cv (Summer) 0.750
Return Period (years) 100	Cv (Winter) 0.840
Region England and Wales	Impermeable Area (ha) 0.440
Map M5-60 (mm) 20 200	Maximum Allowable Discharge (l/s) 9.3
Ratio R 0.262	Infiltration Coefficient (m/hr) 0.00000
	Safety Factor 2.0
	Climate Change (%) 30

Results	
Global Variables require approximate storage of between 192 m³ and 319 m³. These values are estimates only and should not be used for design purposes.	

Appendix I: Photographs

This page has been left intentionally blank

320110892P



320110892P



320110892P



320110892P



320110892P



320110892P



320110892P



Appendix J: Notes of Limitation

The data essentially comprised a study of available documented information from various sources together with discussions with relevant authorities and other interested parties. There may also be circumstances at the site that are not documented. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion if warranted.

It should be noted that any risks identified in this report are perceived risks based on the available information.

This report was prepared by Betts Associates Ltd for the sole and exclusive use of the titled client in response to particular instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

This document has been prepared for the titled project only and should any third party wish to use or rely upon the contents of the report, written approval from Betts Associates Ltd must be sought.

Betts Associates Ltd accepts no responsibility or liability for the consequences of this document being used for the purpose other than that for which it was commissioned and for this document to any other party other than the person by whom it was commissioned.