Report No. 800/71r4

FLOOD RISK ASSESSMENT REPORT

AT

D A N C E L A N E
C R A N E M O O R
N E A R B A R N S L E Y

ON BEHALF OF

M R D T A S K E R

NOVEMBER 2011

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1.0 INTRODUCTION

1.1 Mr D Tasker is proposing to make a Planning Application for construction of a dwelling on land off Dance Lane, Crane Moor. In order to assist in the viability of the project, and to supplement any Planning Application, a Flood Risk Assessment Report was considered appropriate.

1.2 As part of the Planning Application, Planning Policy Statement PPS3 "Housing" clearly identifies flood risk as a specific material consideration in the allocation and release of sites for new housing. It is within the general development strategy of the Country for development in areas where there is a risk of flooding to be fully assessed to avoid unnecessary increase in the requirement of flood defence. Under Planning Policy Statement PPS25 "Development and Flood Risk", consultation should be undertaken with the Environment Agency, Land Drainage Authority and Water Authority and a Flood Risk Assessment Report should be prepared considering the development proposals.

1.3 ARP Associates have been appointed to carry out an assessment of the site, implement appropriate consultations and prepare a Flood Risk Assessment Report, in accordance with PPS25, to satisfy the requirements of the Planning Authority.

1.4 A Flood Risk Assessment Report was prepared in May 2009 for the construction of 2No. dwellings on this particular site. This report was prepared to supplement a planning appeal for proposed development, and it was accepted that a development of this nature could be accommodated with appropriate mitigation measures to offset flooding implications. This report updates the previous Flood Risk Assessment for the proposed construction of a single dwelling on the land with the original consultations and walkover survey carried out March and April 2009 still considered to be appropriate.

1.5 This assessment has been prepared for the sole use and reliance of the Appointee and shall not be relied upon or transferred to any other parties without the written authorisation of ARP Associates. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.

2.0 SITE WALKOVER

2.1 The site is an irregular triangle shaped piece of land located in the village of Crane Moor on the edge of the residential development areas. The site equates to an area of approximately 0.27ha and is situated at Ordnance Survey Grid Reference SE307 014.

2.2 A site location plan is presented in Appendix A.

Current Use

2.3 The site is presently an unmaintained and unused area, although the southern boundary is formed by a gravel access road to a sewerage works to the east.

Topography and Vegetation

2.4 The site slopes relatively steeply from north to south, although the track forming the southern part of the site is flat. There is also a slight perceived fall from west to east.

2.5 The site is covered in grass and brambles and there are some semi-mature trees and bushes along the northern and eastern boundaries. There is a self-seeded semi-mature tree situated within the site, and some large mature dead trees further to the south. The grass banking to the east rises up to residential dwellings beyond.

Boundaries and Environs

2.6 The northern boundary is formed by the fence to residential dwellings off Cliffe Avenue, a sub-station in the centre of the boundary and a telegraph pole with overhead cables is also present at this location. Part of the northern boundary adjacent to the Cliffe Avenue is open with a grass banking beyond rising up to bungalow dwellings further to the north. The eastern boundary has a post and rail fence over the northern part with agricultural fields beyond and a metal security fence to the southern part adjacent to the Yorkshire Water sewerage works. The western boundary is formed by Dance Lane with new

residential development beyond, whilst the southern boundary is open with similar unmaintained grassland and Crane Moor Dike is approximately 8m from the site at its nearest point. This Dike is relatively shallow and flows from west to east with what appears to be washland or flood plain between the site boundary and the Dike. The land to the south of the Dike rises up steeply to agricultural land.

2.7 There is a road bridge over Crane Moor Dike to the southwest on Dance Lane, and this is a typical double arched structure providing access for a country road with two stone parapets. It is anticipated that the capacity of the double arch is low and this will cause a constriction in the water flow of the Dike and flooding to the west of the development on low lying undeveloped grassland.

2.8 The next "constriction" on the Dike is at Gudgeon Hole Lane some 300m to the east and this is a similar road bridge with double arch construction, which is again likely to cause localised flooding. However, it should be noted that the Dike meanders significantly prior to this location and there is sufficient low lying land to prevent any back flow of water to the proposed development, or cause flooding of property or third party land.

Drainage

2.9 There is no positive drainage system on the site, and any overland water will flow off to the south and into Crane Moor Dike.

2.10 The residential development on Cliffe Avenue has clear indications of positive drainage, with gutters and rainwater downpipes on the properties, and there are gullies in the highway with manhole covers, which presumably discharge to a positive system and away from the site. Consequently, there will be no run-off of water from the higher land to the north into the development during general storm conditions.

2.11 There is a manhole in the grass banking immediately adjacent to the turning head at the bottom of Cliffe Avenue. There are gullies on Dance Lane, but there is no positive drainage beyond the junction with Cliffe Avenue.

Local Information

2.12 From information provided at the planning stage, it is clear that the heavy storms of 2007 caused a capacity problem in the sewers on Cliffe Avenue, and some water backed up and overran the land immediately to the west of the proposed dwellings. Furthermore, water also ran along Dance Lane several millimetres deep down the steeply sloping highway and ran into the Dike near the bridge. The Dike also flooded the land directly to the south of the development by the gravel road.

3.0 ENVIRONMENT AGENCY CONSULTATION

3.1 A consultation was requested from the Environment Agency and a copy of their response, reference RFI/2009/8511 dated 6th April 2009, is presented in Appendix B.

3.2 The Environment Agency has no information relating to risk of flooding on this site, but recommend that consultation is made with the Local Authority who may have further information on localised flooding from other sources.

3.3 The site is situated outside the flood plain.

3.4 Any Flood Risk Assessment must assess surface water run-off from the development. Greenfield development sites should balance surface water discharge to the 1 in 1 year greenfield run-off rate, and this is considered to be 5l/s/ha.

3.5 Sustainable urban techniques should be considered to tackle surface water run-off problems at source wherever possible. This could involve the use of soakaways, permeable pavements, grass swales, infiltration trenches, ponds and wetlands to attenuate flood peak flows.

3.6 No maps or plans were provided with the consultation, and therefore, the Environment Agency website was viewed and a copy of the flood map plan is also presented in Appendix B. This shows that there are no indications of potential flooding, and the site can be deemed to fall within Flood Zone 1 in accordance with PPS25 .

4.0 WATER AUTHORITY CONSULTATION

4.1 A consultation was requested from Yorkshire Water, who are the Water Authority for this area, and a copy of their response, reference K001999 dated 7th April 2009, is presented in Appendix C for reference purposes.

4.2 There is a 225mm diameter public combined sewer recorded crossing the site. No buildings are to be erected within 3m, nor trees planted within 5m of the sewer. It may be possible for the sewer to be diverted under 185 of the Water Industry Act 1991 subject to an appropriate application.

4.3 There is a Waste Water Treatment Works located near to the site, and vehicular access, including large tankers, will need to be maintained.

4.4 In respect of foul water, this can discharge to the 225mm diameter public combined sewer crossing the site. However, the local Waste Water Treatment Works at Crane Moor may only have limited spare capacity. Yorkshire Water are to contact the Area Asset Manager and will provide further information regarding the impact of the proposed development, as necessary. No response has been received since April 2009, and it is assumed that capacity is available for foul discharge from the new development.

4.5 In respect of surface water, attention is drawn to Requirement H3 of Building Regulations 2000 and Sustainable Drainage Systems. Furthermore, there are no adequate public surface water sewers available in the vicinity to accept any surface water discharge from the site. Recommendation is made to contact the Environment Agency/Land Drainage Authority with a view to disposal of surface water to the watercourse.

4.6 No land drainage shall be connected or discharged to the public sewer.

5.0 LAND DRAINAGE AUTHORITY CONSULTATION

5.1 A consultation was requested from Barnsley Metropolitan District Council, who are the Land Drainage Authority for this area, and a copy of their response, reference EMDRD/SK dated 22nd April 2009, is presented in Appendix D for reference purposes.

5.2 Extensive flooding occurred in the Crane Moor area in June 2007 and to a lesser extent on two occasions since. This is due to overflow from surface water run-off from upstream land.

5.3 There is no record of flooding on the proposed site.

5.4 Surface water run-off shall be restricted to greenfield rate of 5l/s/ha.

5.5 There is a private surface water sewer running through the site.

6.0 MATERIAL CONSIDERATION IN RESPECT OF PPS25

Flood Classification

6.1 The consultation with the Environment Agency shows that the site falls within Flood Zone 1 "low probability", which has a less than a 1 in 1,000 annual probability of river flooding in any year (less than 0.1%). All uses of land are appropriate in this zone.

End Use

6.2 The development proposal is for the construction of a detached dwelling towards the southwestern area of the site, as shown on the plan presented in Appendix E. When applying Table D2, Annex D of PPS25, the flood risk vulnerability classification shows that the proposed end use will fall into a "more vulnerable" classification.

Sequential Test

6.3 Annex D of PPS25 states that the risk based Sequential Test should be applied at all stages of planning with a view to ensuring new development areas are located in the lowest probability of flooding (Zone 1).

6.4 When the site is evaluated in accordance with Table D3, Annex D of PPS25, the development is considered to be appropriate, and the Sequential Test is satisfied with no requirement for an Exception Test in this case.

Flood Sources

6.5 Flooding from Rivers - There are no rivers maintained by the Environment Agency within the vicinity of the site, and there will be no flooding from this source.

6.6 Flooding from Local Watercourses - Crane Moor Dike can be seen to be adjacent to the site to the south, and within 8m of the development in the southwest corner. It is known

that the land to the south of the development was flooded in 2007, but the topographical survey, presented in Appendix F, shows that the development site is much higher than this level and would not be subject to flooding from the watercourse. There is a constriction of the road bridge at Gudgeon Hall Road downstream, where there is a double arch under the highway. However, there is a significant area of low lying land adjacent to the bridge, which will clearly accommodate any backup of water, and it is highly unlikely that this would cause any more flooding, than already occurs, at the development site. Furthermore, the Dike flows under Dance Lane to the west, upstream of the site, and this will restrict flow of water in the Dike to pass through and flow adjacent to the bridge. It is clear that any surcharge of water upstream will be held at this location and cause flooding of low lying areas to the west of the bridge. However, consideration would need to be given in the event that there is a blockage immediately downstream of the development site, which would cause a greater level of flooding, and which could affect the site.

6.7 Flooding From The Sea - The site is not located near enough to the sea to cause a problem of flooding from this source.

6.8 Flooding From Land - The area to the north of the site on the higher ground is a residential area with a positive drainage system for both properties and the highway. Therefore, in normal storm conditions, it is highly unlikely there would be any water run-off from this area into the site. It is, therefore, highly unlikely that flooding will occur from this source.

6.9 Flooding From Groundwater - As the site is located within a built-up area and the presence of the watercourse to the south indicates that the natural strata are likely to be impervious, then it is highly unlikely that flooding from groundwater will occur, and this is considered to be low risk.

6.10 Flooding from Sewer - It is known that the drainage system on Cliffe Avenue and Dance Lane was proved to have inadequate capacity in the major storms of 2007, and water flowed overland from these locations to Crane Moor Dike to the south. The water on

Dance Lane would have entered the Dike to the west of the development, whilst the water from Cliffe Avenue would have passed through the centre of the site and overland direct to the Dike. A similar situation could occur from a blocked sewer, and this will result in flooding from the lowest cover level to manholes or gullies which will be to the southern end of Cliffe Avenue. This will need to be considered as part of the proposed development and in any flood mitigation measures.

6.11 Flooding from Reserviours, Canals And Other Artificial Sources - There are no other sources, such as these, which would result in flooding on the site.

Climatic Change

6.12 Annex B of PPS25 indicates that winters will become wetter over the whole of the UK, by as much as 20% by the 2050s. A shift in the seasonable pattern of rainfall is also expected, with summers and autumns becoming much drier than at present. In making an assessment of the impact of climatic change on flooding from land, rivers and sea, Table B.2 indicates that the peak rainfall intensity for developments likely to extend to between 2055 and 2085 is 20% and peak river flow between 2025 and 2115 is also expected to rise by 20%. If development is expected to extend past 2085, then a 30% peak rainfall intensity should be considered.

6.13 The site falls from north to south, but the adjoining area to the northern boundary is a residential area with positive drainage systems throughout. Therefore, any run-off from outside the site boundary will be insignificant during standard storms and, on this basis, only rainfall falling within the site boundaries will need to be considered in respect of climatic change.

6.14 The latest published figures in PPS25 show that, for an anticipated life of 50 years for any new development, then the anticipated increase in rainfall would be around 20%. It will be necessary to design any new positive drainage system with a 20% increase in capacity to accommodate this requirement.

Flood Mitigation

6.15 The site falls within Flood Zone 1, and there is no indication that the site has flooded in the past from the adjacent watercourse and, in these circumstances, no mitigation measures will be required. However, it will be necessary to take account of potential sources of flooding from extreme storm conditions which may result in greater flooding from the Dike and overland flood water from a blocked or under capacity sewer in Cliffe Avenue. Therefore, the following mitigation measures are recommended.

6.15.1 The ground floor to the proposed buildings shall be raised a minimum 600mm above the level of the track providing access to the sewerage works to accommodate extreme flood and climatic change for the life of the development.

6.15.2 The ground floor to the buildings will be solid concrete construction with no subfloor voids.

6.15.3 Incoming electricity supply shall be raised above ground floor level and ground floor electric sockets shall be served by loops from upper level, as opposed from under ground floor level.

6.15.4 External levels to the proposed dwelling shall be designed with a satisfactory route for flood water from the boundary of Cliffe Avenue to ensure that this water will pass through the development to the Dike to the south. Detailed design levels showing the flood route of the potential water shall be forwarded to the Planning Authority for approval prior to construction on site. However, it is clear from an assessment of the proposed layout that a scheme can be designed to accommodate this requirement.

6.16 The use of Sustainable Drainage techniques shall be considered in the final design. There is no information relating to intrusive investigation of the ground conditions for

suitability of infiltration techniques. However, the geology plan shows that the site is located on the Coal Measures, which is likely to have undifferentiated strata of siltstones, mudstones and sandstones, overlaid by weathering to a clay soil and cohesive Glacial Till materials from the watercourse. These materials are likely to be unsuitable for soakaways or other infiltration techniques, and the presence of the watercourse in close proximity to the site confirms this interpretation of the permeability of the soils. Therefore, soakaway or other similar sustainable infiltration systems are not considered to be suitable at this location and, for the purposes of this report, it is assumed that a full positive drainage system will be required for the new development.

Drainage

6.17 It is a requirement to ensure that surface water run-off from any proposed development has negligible consequence on downstream areas either in sewer capacity or discharge to watercourse.

6.18 Existing Surface Run-off - The site is presently greenfield with sloping land from north to south, which will give greenfield run-off to the Crane Moor Dike watercourse. For the proposed development area, this equates to around 0.014ha, which at 5l/s/ha gives a discharge rate of 0.07l/s. If surface water was to discharge to the watercourse, then the restriction to 0.07l/s would result in an extremely small outlet diameter which could have the potential to block regularly and cause overland water to run out of the lowest manhole and across the land to the Dike. This is not an ideal situation, as the owners would need regular maintenance of the system.

6.19 It is known that there is an adopted sewer crossing through the site and that the proposed development makes allowance for a 6m easement (3m either side) to comply with the requirements of Yorkshire Water. However, it is also indicated that the private surface water drainage to the rear of the plots on the eastern side of Cliffe Avenue passes through the site. In these circumstances, it can be seen that there is in the region of 208m² of impermeable area draining through this system into the development site. It is assumed that this pipe will connect into the adopted sewer or outfall to the watercourse, and taking

a standard 50mm/hr storm, the existing discharge rate will be 2.9l/s. Calculations relating to the two discharge rates are presented in Appendix G.

6.20 Proposed Surface Water Drainage - If surface water discharges to the watercourse at an existing discharge rate of 0.07l/s, then, after making an allowance of climatic change, the indicative calculations using the WinDES Source Control Computer Program show that, for a proposed impermeable area of 142m², a storage volume of around 5.6m³ is required for a 1 in 30 year storm. However, by discharging to the existing connection from the properties on Cliffe Avenue and adding the impermeable area from the proposed dwellings, the indicative calculations show that, after making an allowance for climatic change, an attenuation of 4.8m³ would be required for a 1 in 30 year storm restricted to the discharge of 2.9l/s from the existing run-off. This system has the benefit of restricting discharge to the outfall to a standard 1 in 1 year storm without creating surcharge of the system during heavier storms. This benefits the existing system and should be acceptable to Yorkshire Water or the Environment Agency. It will be necessary, however, to accommodate the existing private drains crossing the site as a matter of course. This creates a benefit to the existing residents of having a new system and connection downstream which will meet present day Standards and improve the flow through their system.

6.21 The attenuation required can be achieved by several methods, including ponds, oversized pipes and underground storage tanks, such as cellular cells, and the calculations, which are presented in Appendix H for reference, show that one such system could be 9m of 0.9m diameter oversized pipe or equivalent for discharge to the watercourse, or 8m of 0.9m diameter oversized pipe or equivalent for connection to sewer. The proposals will also need to ensure that the 1 in 100 year storm can be stored on site without causing flooding to property. Detailed calculations and proposals shall be submitted to the Planning Authority for approval prior to construction on site. However, it is clear from an assessment of the proposed layout that a scheme can be designed to accommodate this requirement.

6.22 Foul Drainage - Foul drainage can discharge to the 225mm diameter combined sewer crossing through the site. No further consultation has been received from Yorkshire Water regarding the capacity of the Waste Water Treatment Works, but the flow from a single property is insignificant in terms of the overall flow into the treatment works, and it is not anticipated there would be any significant problem. If Yorkshire Water do not accept a connection for foul drainage, then this would need to be resolved by the installation of septic tanks or a small treatment works for the proposed dwelling.

Emergency Egress During Times of Flood

6.23 It is a requirement under PPS25 that occupants should be able to egress any building during times of flood, without being trapped by flood conditions.

6.24 The site is shown to be within Flood Zone 1 with no indication of flooding on the site and, therefore, there are no mitigation measures required in this respect.

7.0 COMMENT

7.1 The site falls within Flood Zone 1 and the Sequential Test is satisfied. However, flood mitigation measures need to be considered in the possible event of extreme storm and flooding from the watercourse or from blocked or inadequate capacity of sewers creating overland water from the north. Therefore, the following flood mitigation measures are recommended.

7.1.1 The ground floor to the proposed building shall be raised a minimum 600mm above the existing ground level on the gravel track to the south.

7.1.2 The ground floor to the buildings will be solid concrete construction with no subfloor void or basement.

7.1.3 Incoming electricity supplies shall be raised above the proposed ground floor level and ground floor electric sockets shall be served by loops from the first floor level.

7.1.4 The external levels to the development shall be designed to ensure overland flood water from Cliffe Avenue is directed past the dwelling without causing flooding, and allows discharge to the Crane Moor Dike to the south. Details of the external levels design shall be submitted to the Planning Authority for approval prior to construction.

7.2 Climatic change for a 20% increase in rainfall shall be incorporated into any drainage designs.

7.3 Sustainable Drainage system of infiltration techniques should be considered, but it is anticipated that the ground conditions will be unsuitable on this particular site.

7.4 Surface water discharge shall be restricted to the existing run-off of either 0.07l/s direct to the watercourse, or to utilise the existing flow from properties on Cliffe Avenue of 2.9l/s with discharge to the existing outfall.

7.5 The proposed surface water drainage system shall accommodate climatic change, and be designed with appropriate attenuation to restrict discharge to the existing run-off. The proposals and calculations shall be submitted to the Planning Authority for approval prior to construction.

7.6 The existing combined sewer crossing the site will need to be accommodated in the proposed layout to ensure that there is a 6m easement (3m either side of pipe) to meet the requirements of Yorkshire Water.

7.7 The existing private surface water drainage system from Cliffe Avenue crossing the site will need to be accommodated within the proposals and connections to outfall maintained.

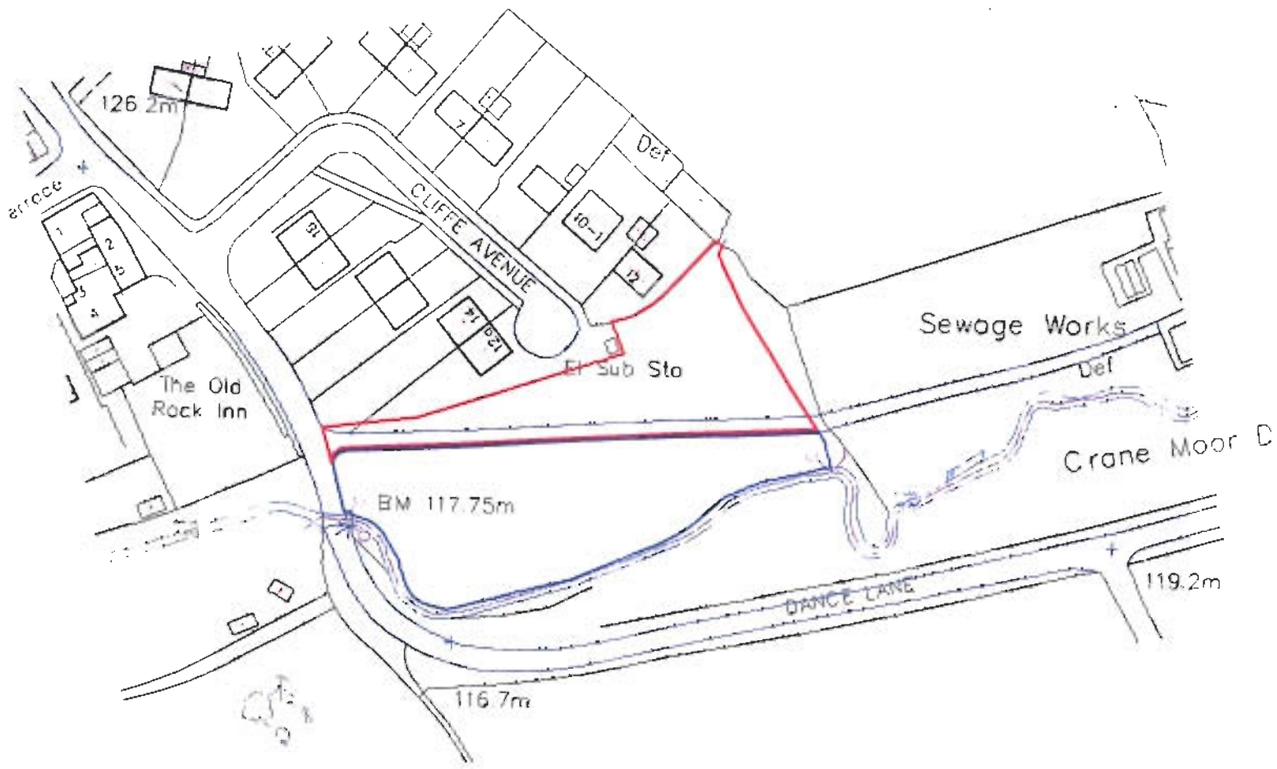
7.8 No special mitigation measures are required for emergency egress during times of flood.

7.9 Subject to compliance with the above, the proposed development can satisfy the requirements of Planning Policy Statement 25 'Development and Flood Risk'.

A P P E N D I X A

SITE LOCATION PLAN





Rev	By	Date	Amendment	Chk
	MW		Issued for Approval	

Project
DANCE LANE, CRANE MOOR, NR. BARNSLEY

Client
PAUL WINFIELD & SON

Title
SITE LOCATION PLAN

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CHARTERED CONSULTING ENGINEERS
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Tel: 0113 2458498 • Fax: 0113 2443854 • E-Mail: Leeds@arpassociates.co.uk

Date MAR 09
Scale 1:1250
Drawn MW
Chk. ARP
No 800/71/FR.01
Rev

A P P E N D I X B

ENVIRONMENT AGENCY CONSULTATION

Allan Poyser

From: Andrew Radcliffe
Sent: Monday 06 April, 2009 4:06 pm
To: Allan Poyser
Subject: FW: Your Enquiry: RFI/2009/8511

-----Original Message-----
From: Riley, Stacey [mailto:stacey.riley@Environment-agency.gov.uk]
Sent: 06 April 2009 3:49 pm
To: Andrew Radcliffe
Subject: Your Enquiry: RFI/2009/8511

Our Ref: RFI/2009/8511

Your Ref: 800/71/ARP/jc

Dear Mr Poyser

RE: Dance Lane Crane Moor Barnsley

Thank you for your enquiry dated 24th March 2009.

We have no information relating to the risk of flooding, or any occurrence of flooding on this site. Our records are generally related to flooding from 'main rivers', therefore we suggest you consult the local authority who may have further information on localised flooding from other sources.

Whilst the site is outside the floodplain, any development could generate significant volumes of surface water. A flood risk assessment must be submitted with a planning application on any proposed development to assess the existing and proposed surface water drainage from the site.

There should be no increase in surface water runoff from the new development. If the existing site is designated as brownfield, then we would expect surface water from the re-developed site to be reduced by a minimum of 30% from the existing rate. Greenfield development sites should balance surface water discharge to the 1 in 1 year Greenfield run-off rate, this is considered to be 5 l/sec/ha.

Sustainable Urban Drainage techniques (SUDs) tackle surface water run-off problems at source using features such as soakaways, permeable pavements, grassed swales, infiltration trenches, ponds and wetlands to attenuate flood peak flows, produce water quality improvements and environmental enhancements. We would seek to promote the use of SUDs techniques to the site when it is developed and would expect any potential developer of the site to submit detailed information indicating that the use of SUD's has been fully explored. For more information on SUD's can be found at: http://www.ciria.org.uk/suds/

This information is based on data that is currently available to the Environment Agency and is subject to our standard notice. The Agency accepts no liability for any loss or damage arising from its use. The interpretation of the information is your responsibility.

If you require any further help, please do not hesitate to contact me.

07/04/2009

Yours sincerely,

Stacey Riley

External Relations Officer

☎ 0113 3954506 (Internal 728 4506)

✉ stacey.riley@environment-agency.gov.uk

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07/04/2009

Environment Agency



Flooding

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Crane Moor, Barnsley

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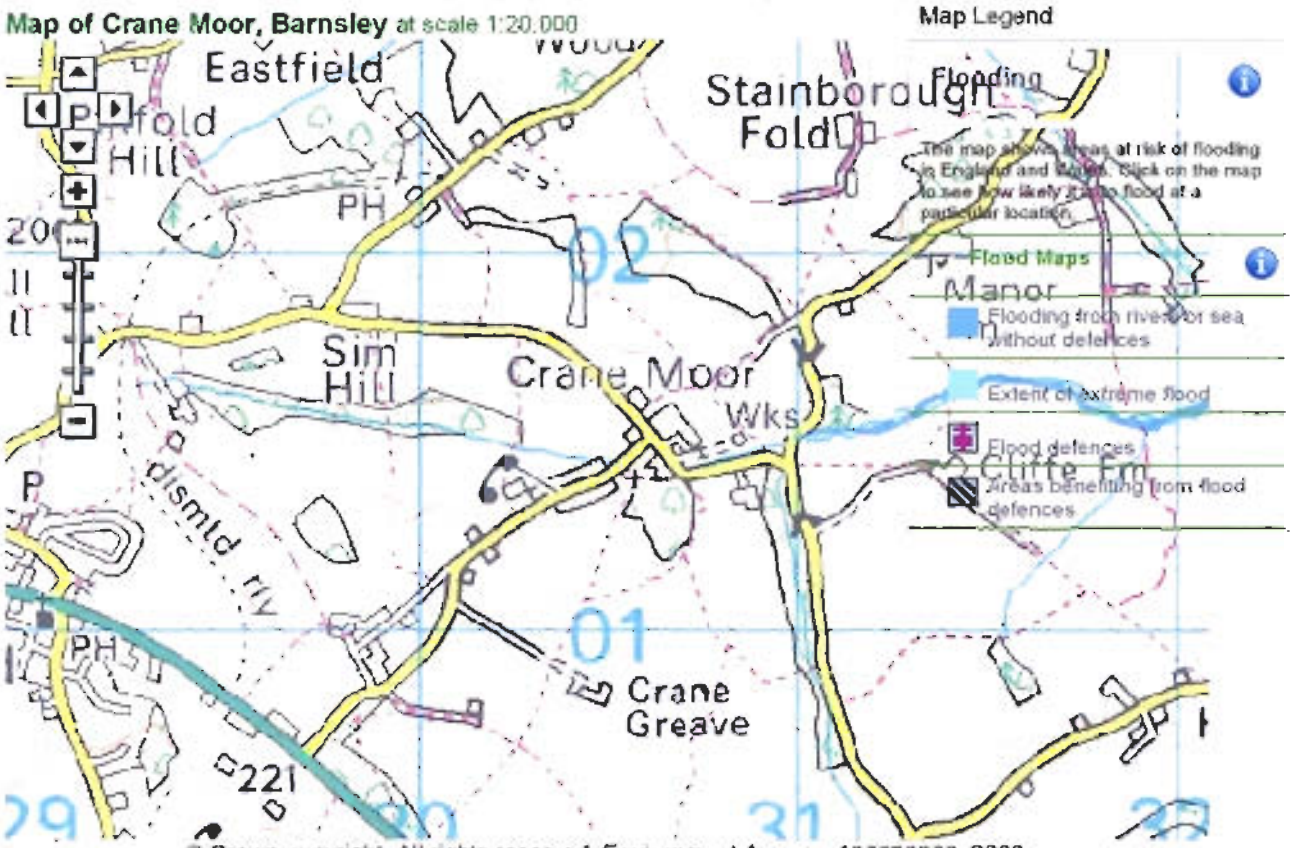
Overview map:



Other topics for this area...

- Flood Risk
- Flood Warning
- Rivers
- Bathing Water Quality
- Drinking Water
- Industrial Pollution
- Waste
- River Basin Management Plans - Rivers
- River Basin Management Plans - Lakes
- River Basin Management Plans - Coastal Waters
- River Basin Management Plans - Estuarine
- River Basin Management Plans - Groundwater
- Air Pollution
- Environment Agency Offices

Map of Crane Moor, Barnsley at scale 1:20,000



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view text version of all results

See also:

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.

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We can't always stop rivers from flooding, but we can tell you when it's going to happen. Our free service provides flood warnings direct to you by telephone, mobile, fax or pager.

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I am in a floodplain, will this affect my insurance?

Flood map - your questions answered
Answers to commonly asked questions about the flood map.

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Author: The Environment Agency | enquiries@environment-agency.gov.uk
Last updated: 20 January 2009

A P P E N D I X C

WATER AUTHORITY CONSULTATION

YorkshireWater



Yorkshire Water
New Development Team Sewerage
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Halifax Road
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Tel: (0845)1242424
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For telephone enquiries ring:
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ARP Associates
5/6 Northwest House
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LEEDS
LS6 2QH

For the attention of Mr A Poyser

Your Ref: 800/71
Our Ref: K001999

7th April 2009

Dear Sir/Madam,

Dance Lane, Crane Moor, Barnsley - Pre-Planning Sewerage Enquiry - Residential

Thank you for your enquiry of 25th March 2009. Our charge of £60.00 (plus VAT) will be added to your account with us, reference ARP013. You will receive an invoice for your account in due course.

Please find enclosed a complimentary extract from the Statutory Sewer Map. This indicates the recorded position of the public sewers. The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site:

There is a 225 mm diameter public combined sewer recorded crossing the site. No buildings are to be erected within 3 (three) metres, nor trees planted within 5 (five) metres of this public sewer. It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes on the sewer. If you wish to have this sewer diverted under Section 185 of the Water Industry Act 1991 an application should be made in writing. To discuss this matter, please telephone 0845 124 24 24.

There is a waste water treatment works (WWTW), under the control of Yorkshire Water, located near to the site. Vehicular access, including with large tankers, could be required at any time.

The site lies within 200 m of the waste water treatment works. It is likely that future occupiers would encounter smell/fly nuisance associated with works operation. Local residents have confirmed that they experience fly nuisance problems in the summer months & these could be associated with the waste water treatment works.

The local Waste Water Treatment Works (WWTW) is Crane Moore. It is understood that this WWTW may only have limited spare capacity, if any, available. We have contacted the Area Asset Manager for more information regarding the impact of proposed development and will contact you when an assessment has been made.

Development of the site should take place with separate systems for foul and surface water drainage. The separate system should extend to the public sewer.

Foul water should discharge to the 225 mm diameter public combined sewer recorded crossing/within the site.

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to

INVESTING IN VOLUNTEERS FOR EMPLOYERS
CHARTER MARK CUSTOMER SERVICE EXCELLENCE

discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SUDS), for example the use of soakaways and/or permeable hardstanding etc., may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SUDS in this instance from the appropriate authorities.

Where appropriate, soakaways, swales and infiltration trenches (SUDS) may be adopted as part of the public sewer network. For general conditions for the adoption of SUDS please see the attached sheet. Further information may be seen in the DEFRA publication 'Interim Code of Practice for Sustainable Drainage Systems' (ISBN 0-86017-904-4). If the developer is considering adoption of SUDS he should contact our New Development Team at Sheffield on 0845 124 24 24.

There are no adequate public surface water sewers available in the vicinity to accept any surface water discharge from this site. Therefore, I would advise you to contact the Environment Agency/local Land Drainage Authority with a view to establishing a suitable watercourse for discharge.

It is understood that a watercourse is located to the south of the site. This appears to be the obvious place for surface water disposal.

An off-site surface water sewer may be required which may be provided by the developer and considered for adoption under Section 104 of the Water Industry Act 1991. Please telephone 0845 124 24 24 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0845 124 24 24.

Prospectively adoptable sewers must be designed and constructed in accordance with the WRc publication "Sewers for Adoption - a design and construction guide for developers" 6th Edition as supplemented by Yorkshire Water's requirements, pursuant to an agreement under Section 104 of the Water Industry Act 1991. An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our New Development Team at Sheffield (telephone 0845 124 24 24) for further information.

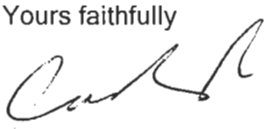
The public sewer network is for domestic sewage purposes. This generally means foul water for domestic purposes and, where a suitable surface water or combined sewer is available, surface water from the roofs of buildings together with surface water from paved areas of land appurtenant to those buildings. Land and highway drainage have no right of connection to the public sewer network. Highway drainage, however, may be accepted under certain circumstances; for instance, if SUDS are not a viable option and there is no highway drain available and if capacity is available within the public sewer network. In this event, the developer will be required to enter into a formal agreement with Yorkshire Water Services under Section 115 Water Industry Act 1991 to discharge non-domestic flows into the public sewer network.

No land drainage to be connected/discharged to public sewer.

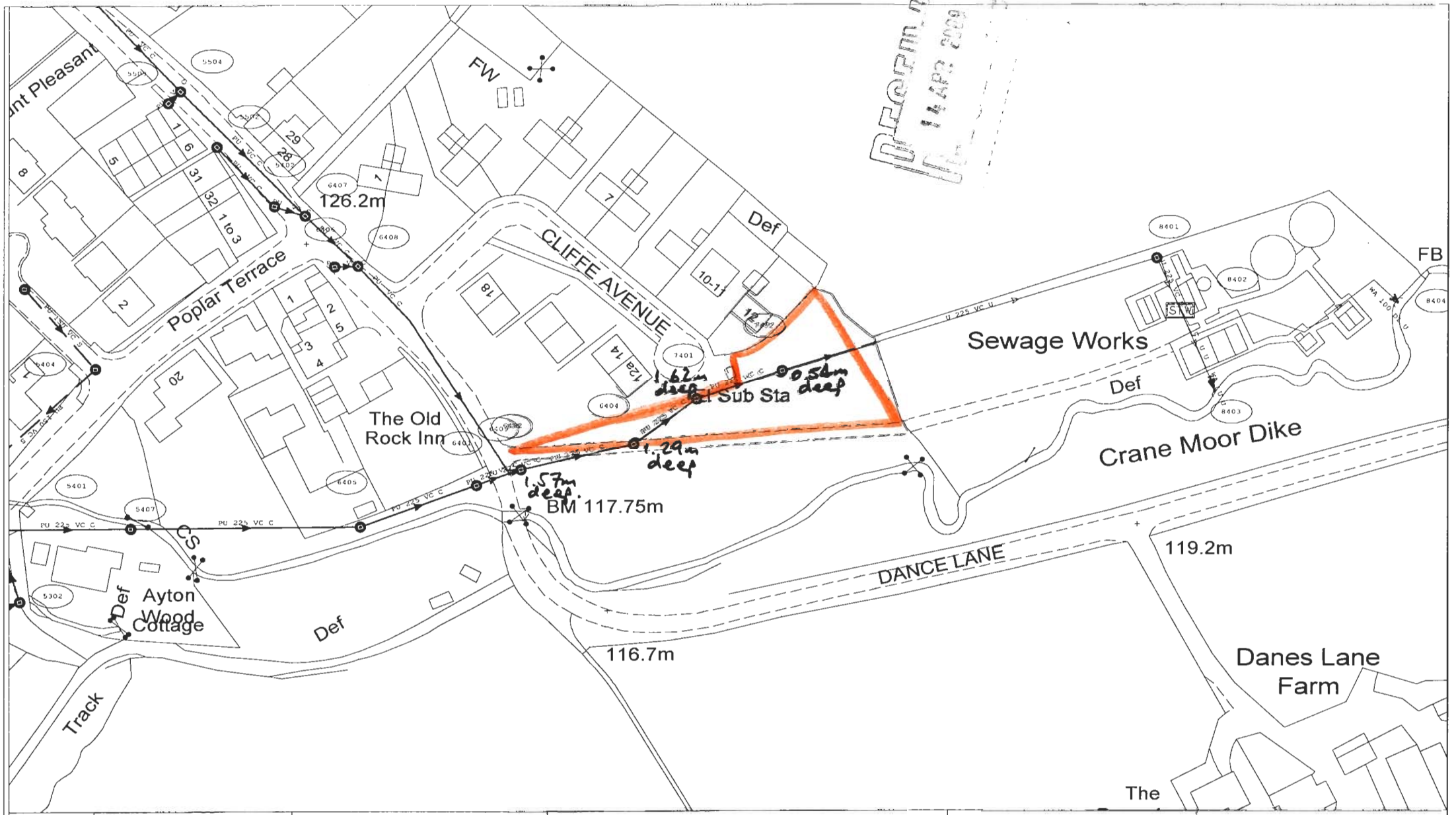
Any new connection to an existing public sewer will require the approval of Yorkshire Water. You may obtain an application form by telephoning 0845 124 24 24.

All the above comments are based upon the information and records available at the present time. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith. Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours faithfully



New Development Team



430517 : 401319	Map Name : SE3001SE	Title	Partial Key Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
YorkshireWater Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : K KHAN Contact Tel :		Notes (Ody) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2004. All rights reserved Ordnance Survey Licence number 100019559	This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connection Date Req : 07/04/2009, 14:45:54 Source : Sewer Network Enquiry Date Gen : 07/04/2009, 14:45:56

UPN: Undefined Originator: K KHAN, New Development - Waste Water,

A P P E N D I X D

LAND DRAINAGE AUTHORITY CONSULTATION

BARNSLEY
Metropolitan Borough Council

Highways and Engineering
Assistant Director: D. A. Richardson, BSc, M.C.I.O.B, M.I.H.T.
PO Box 601 Barnsley S70 9FA

My Ref. EMDRD/SK Your Ref. 800/71/ARPjc

Enquiries to Mr. S. Kilner Dial Direct (01226)772116 Fax (01226)772196

Date 22nd April, 2009

Dear Sir

Paul Winfield and Son
Dance Lane, Crane Moor, Barnsley

I refer to your letter dated 24th March 2009 and our telephone conversation 22nd April, 2009 and would respond to the points raised as below.

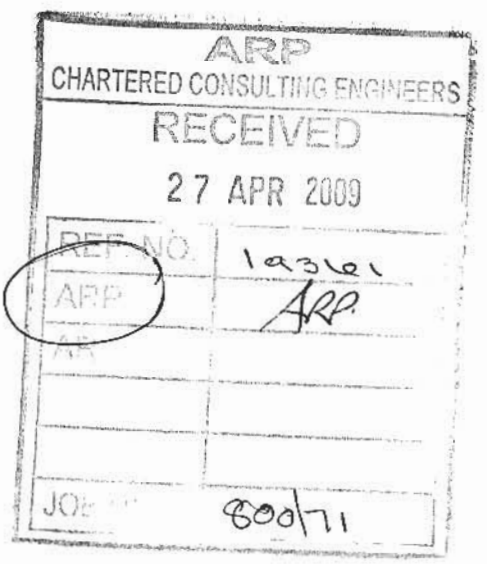
1. I am aware that extensive flooding occurred in the Crane Moor area during the unprecedented storms experienced in June 2007, and to a lesser extent on two occasions since. However I have no record of any flooding of the site indicated on your location plan from Crane Moor Dyke. My understanding is that there is an issue of flooding to this site from surface water run off from upstream land, which should be addressed in your Flood Risk Assessment.

2. Any flows connected into Crane Moor Dyke at this location should be restricted to green field rates of run off of 5 litres/second/hectare. I understand you are aware of a problematic private surface water sewer which runs through the site.

Yours Faithfully

Mr. S. Kilner
Principal Engineer Drainage.

F.a.o. Mr. A R Poyser,
ARP Associates
5/6 Northwest Business Park
Servia Hill
LEEDS
LS6 2QH



A P P E N D I X E

SKETCH LAYOUT OF PROPOSED DEVELOPMENT

1) This drawing and the design and details depicted thereon are the copyright of Peter Dimberline Chartered Architect.
2) All dimensions on this drawing are to be checked by the Contractor and any discrepancies are to be reported to the Architect.
3) Do not scale critical dimensions off this drawing.
4) Contractor to ensure that all Health & Safety requirements (CDM Regulations) in relation to this project will be complied with.



proposed site layout plan 1:200

PETER DIMBERLINE Dip Arch. RIBA
CHARTERED ARCHITECT

2 TIPSEY COURT, STAINCROSS
BARNSLEY, S75 6FZ

tel/fax (01226) 390847
email: pdimberline@tiscali.co.uk

CLIENT
Mr D Tasker

PROJECT
Proposed detached dwelling

LOCATION
Site off Cliffe Avenue,
Crane Moor, Barnsley

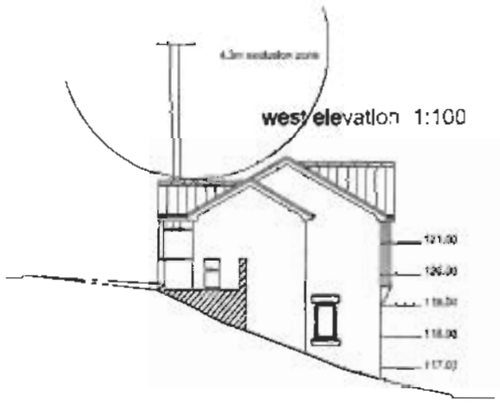
DRAWING
Planning application details
Topographical site layout

SCALE 1:200 DATE Aug. 11

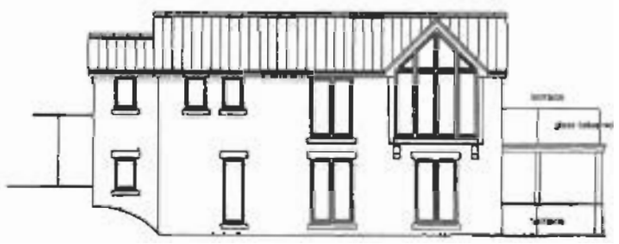
DRWG No. 2010/012/01 DRAWN BY PD

REV.

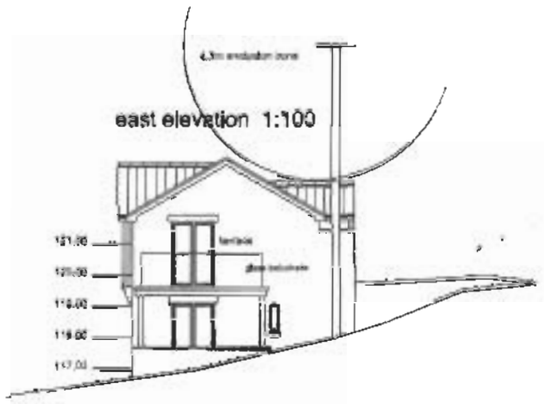
(c) This drawing and the design and details depicted thereon are the copyright of Peter Dimberline Chartered Architect.
2) All dimensions on this drawing are to be checked by the Contractor and any discrepancies are to be reported to the Architect.
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west elevation 1:100



south elevation 1:100

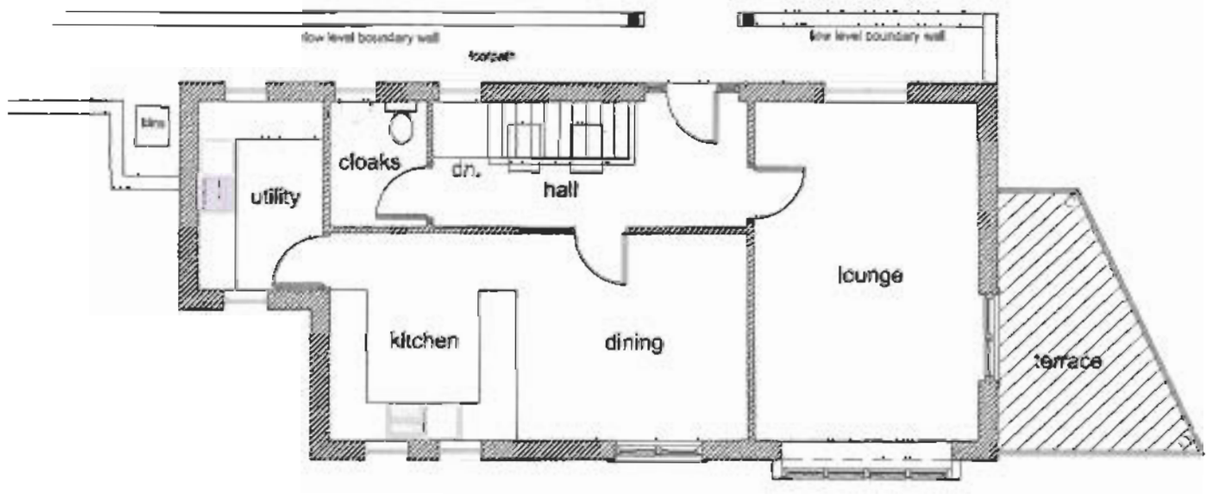


east elevation 1:100

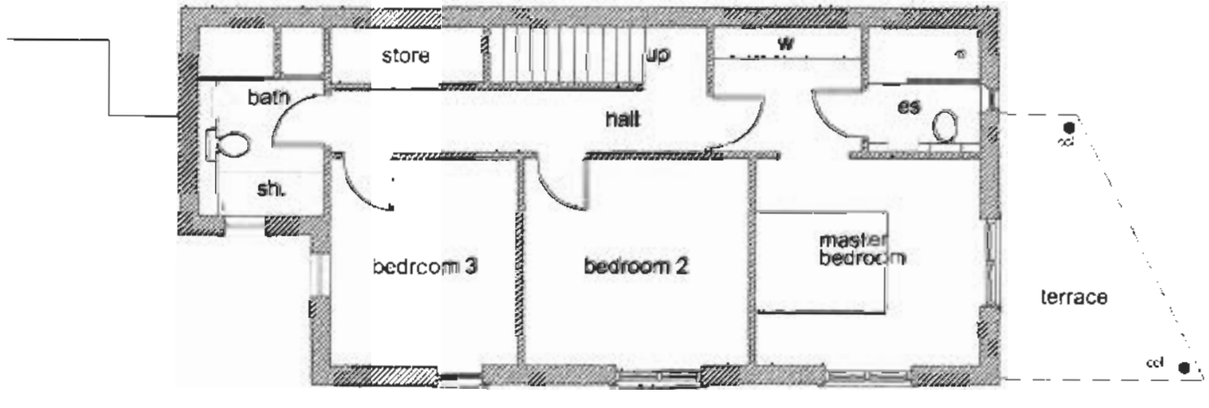


north elevation 1:100

ground floor plan 1:50



lower ground floor plan 1:50



proposed external materials (subject to lpa approval)

walls: to be natural or artificial stone to harmonise with the materials on the adjacent bungalow.

roof: to consist of either natural slate or re-constituted stone or slate effect.

windows and doors: to be pvcu .

PETER DIMBERLINE Dip Arch. RIBA
CHARTERED ARCHITECT
2 TIPSEY COURT, STAINCROSS
BARNSLEY, S75 6FZ
telfax (01226) 390557
email: pdimberline@tiscali.co.uk

CLIENT
Mr D Tasker

PROJECT
Proposed detached dwelling

LOCATION
Site off Cliffe Avenue,
Crane Moor, Barnsley

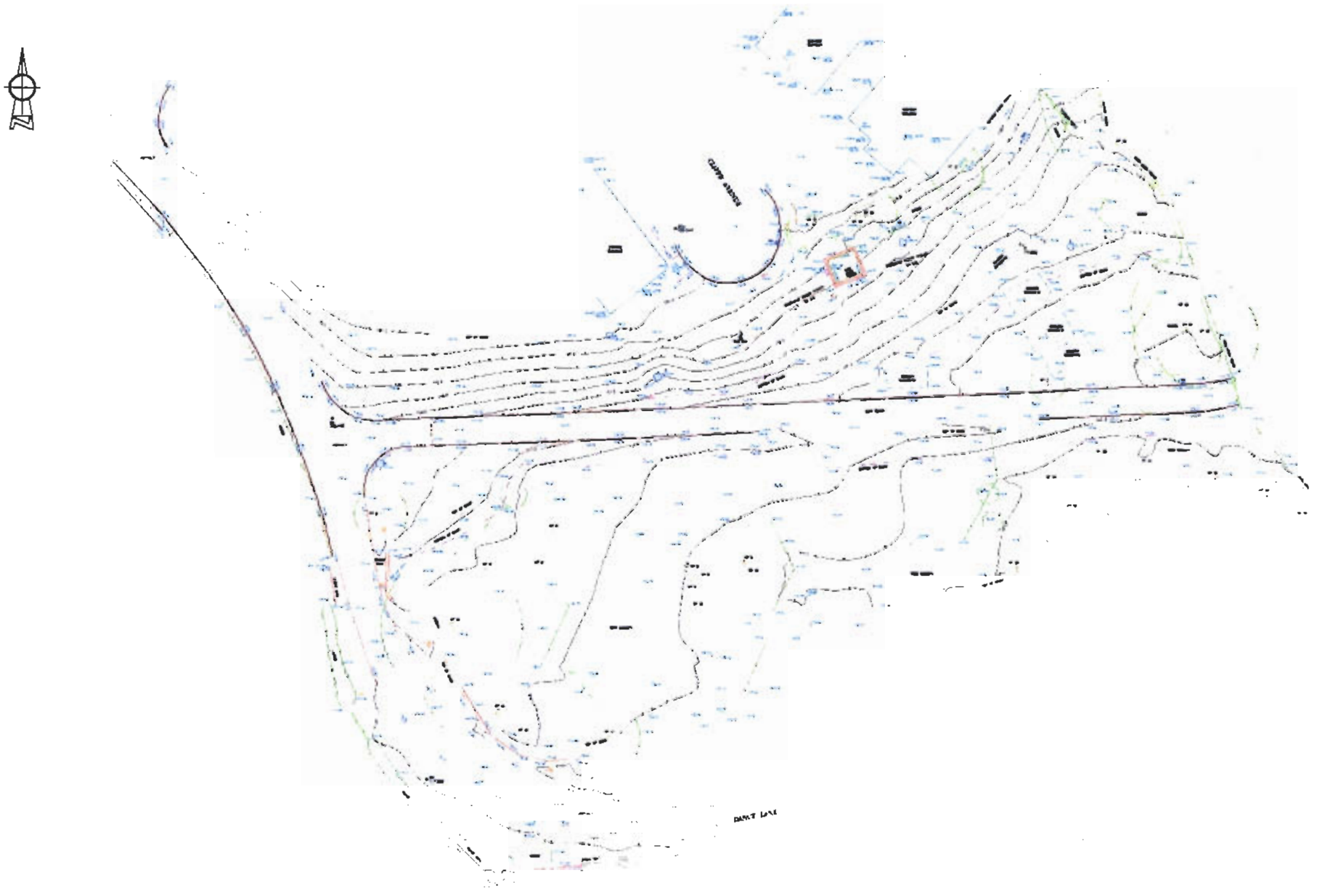
DRAWING
Planning application details
Dwelling plans and elevations

SCALES 1:50 and 1:100 DATE Aug. 11

DRWG No. 2010/012/02 REV. DRAWN BY PD

A P P E N D I X F

TOPOGRAPHICAL SURVEY



Rev	By	Date	Amendment	Chk
	MW		Issued for construction	

Project
DANCE LANE, CRANE MOOR, NR. BARNSLEY

Client
PAUL WINFIELD & SON

Title
TOPOGRAPHICAL SURVEY

ARP ASSOCIATES
CHARTERED CONSULTING ENGINEERS
Northwest House • 6/8 Northwest Business Park • Servia Hill • Leeds LS6 2QH
Tel: 0113 2408499 • Fax: 0113 2443004 • E-Mail: Leeds@arpassociates.co.uk

Date: MAR 09
Scale: 1:500
Drawn: MW
Chk: ARP
No: 800/71/FR.03
Rev:

A P P E N D I X G

EXISTING SURFACE WATER DISCHARGE CALCULATIONS

ARP ASSOCIATES
AND GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

5/6 Northwest Business Park
Servia Hill
Leeds
LS6 2QH
Tel: 0113 245 8498
Fax: 0113 244 3864
E-Mail: leeds@arpassociates.co.uk

Client: MR D. TASKER	Project No. 800/71	Sheet. 1 of 2
Project: DANCE LANE, CRANE MOOR	Calc By. ARP	Date. 7/11/11
Element: EXISTING DISCHARGE RATES	Chkd By.	Date.

(1) FOR DISCHARGE TO WATER COURSE

Area of houses and hard standing $= (12.5 \times 7.0) + (2.5 \times 4.0) + (14.0 \times 1.5) + (4.8 \times 4.8)$

$= 141.5\ m^2.$

Using greenfield run off rate = 5 l/sec/ha.

Discharge = 0.07 l/s.

(2) FOR DISCHARGE OF EXISTING HOUSES TO SEWER.

For rear parts of houses shown on page 2.

Impermeable area =

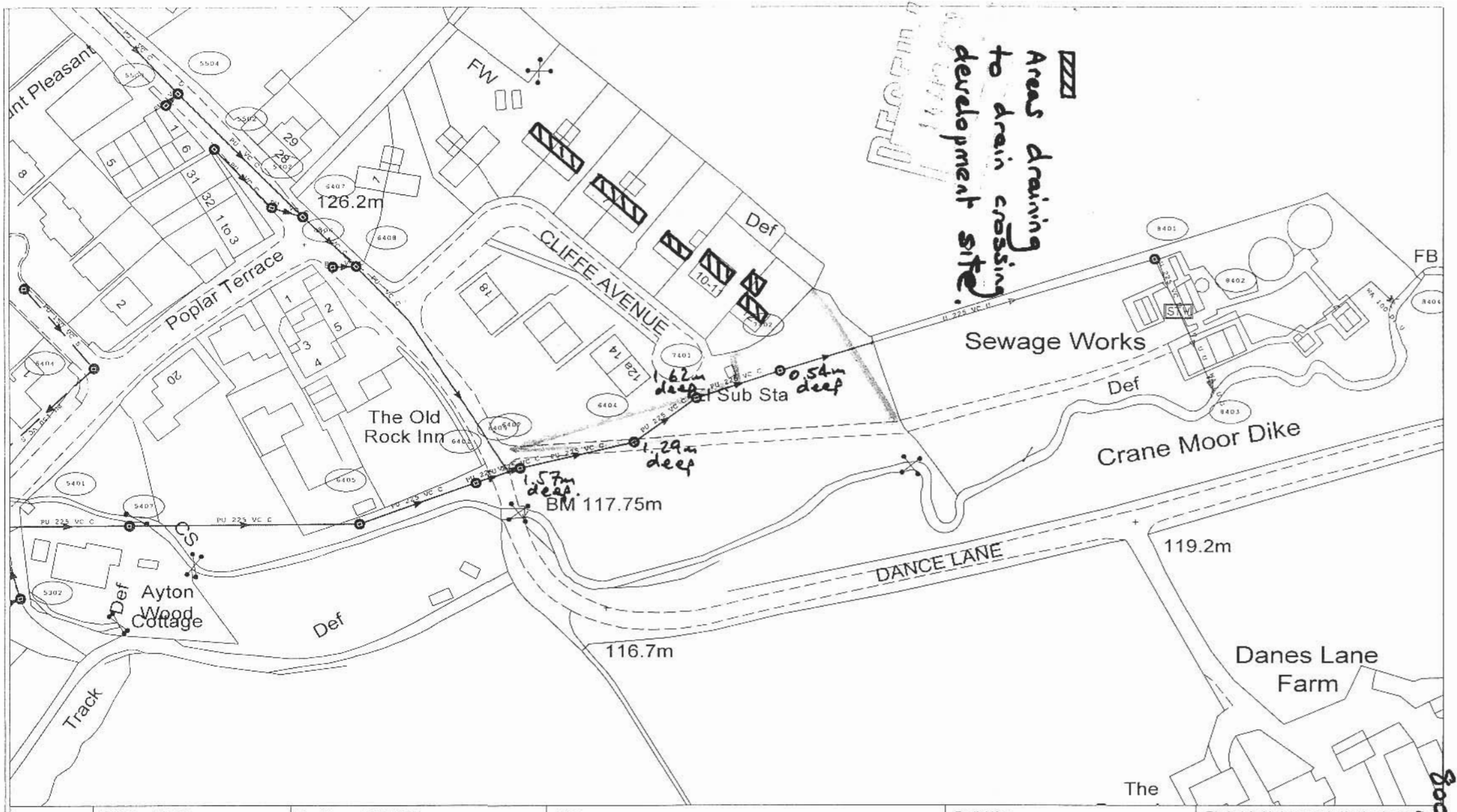
3/5	(15.5×3.25)
7	(16.0×3.0)
9	(8.0×3.0)
10/11	(9.0×4.25)
12	(8.5×3.0)
Garages	(5.0×4.5)

$= 208\ m^2.$

Using a standard 50 mm/hr storm.

Discharge $= 2.78 \times \frac{208}{10000} \times 50$

$= 2.9$ l/s



430517 : 401319	Map Name : SE3001SE	Title	Partial Key Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
YorkshireWater	Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : K KHAN Contact Tel :	Notes	This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connection.
		(Odyl) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2004. All rights reserved Ordnance Survey Licence number 100019559	Date Req : 07/04/2009, 14:45:54 Source : Sewer Network Enquiry
			Date Gen : 07/04/2009, 14:45:56

UPN: Undefined Originator: K KHAN, New Development - Waste Water,

Page 2 of 2

A P P E N D I X H

PROPOSED SURFACE WATER ATTENUATION CALCULATIONS

ARP ASSOCIATES
AND GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

5/6 Northwest Business Park
Servia Hill
Leeds
LS6 2QH
Tel: 0113 245 8498
Fax: 0113 244 3864
E-Mail: leeds@arpassociates.co.uk

Client : MR D. TASKER.	Project No. 800/71	Sheet. 1 of 10
Project : DANCE LANE, CRANE MOOR.	Calc By. ARP	Date. 7/11/11
Element : PROPOSED DRAINAGE SOLUTIONS	Chkd By.	Date.

Proposed Impermeable Area (from Drgs in Appendix E

$I_p = (12.5 \times 7.0) + (2.5 \times 4.0) + (14.0 \times 1.5) + (4.8 \times 4.8)$

$= \underline{\underline{142\ m^2}}$

Discharge to Watercourse

For a discharge rate = 0.07 l/s, and impermeable area of $142\ m^2$, and allowance for climatic change,

Attenuation for 1 in 30 year storm.

$= \underline{\underline{5.6\ m^3}}$

This equates to 9m of 0.9m dia pipe. or equivalent.

The computer output sheets from the WinDES Source Control Computer program are presented on pages 2-5

Summary of Results for 30 year Return Period (+20%)

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m^3)	Maximum Volume (m^3)	Status
15 Summer	0.1	0.0	0.1	100.3252	0.3252	0.0	2.1	O K
30 Summer	0.1	0.0	0.1	100.4007	0.4007	0.0	2.8	O K
60 Summer	0.1	0.0	0.1	100.4772	0.4772	0.0	3.5	O K
120 Summer	0.1	0.0	0.1	100.5508	0.5507	0.0	4.2	O K
180 Summer	0.1	0.0	0.1	100.5878	0.5878	0.0	4.5	O K
240 Summer	0.1	0.0	0.1	100.6077	0.6078	0.0	4.7	O K
360 Summer	0.1	0.0	0.1	100.6258	0.6258	0.0	4.8	O K
480 Summer	0.1	0.0	0.1	100.6308	0.6308	0.0	4.8	O K
600 Summer	0.1	0.0	0.1	100.6323	0.6323	0.0	4.9	O K
720 Summer	0.1	0.0	0.1	100.6318	0.6318	0.0	4.9	O K
960 Summer	0.1	0.0	0.1	100.6263	0.6263	0.0	4.8	O K
1440 Summer	0.1	0.0	0.1	100.6053	0.6053	0.0	4.6	O K
2160 Summer	0.1	0.0	0.1	100.5673	0.5673	0.0	4.3	O K
2880 Summer	0.1	0.0	0.1	100.5307	0.5307	0.0	4.0	O K
4320 Summer	0.1	0.0	0.1	100.4672	0.4672	0.0	3.4	O K
5760 Summer	0.1	0.0	0.1	100.4137	0.4137	0.0	2.9	O K
7200 Summer	0.1	0.0	0.1	100.3697	0.3697	0.0	2.5	O K
8640 Summer	0.1	0.0	0.1	100.3327	0.3327	0.0	2.2	O K
10080 Summer	0.1	0.0	0.1	100.3007	0.3007	0.0	1.9	O K
15 Winter	0.1	0.0	0.1	100.3547	0.3547	0.0	2.4	O K
30 Winter	0.1	0.0	0.1	100.4387	0.4387	0.0	3.1	O K
60 Winter	0.1	0.0	0.1	100.5252	0.5252	0.0	3.9	O K
120 Winter	0.1	0.0	0.1	100.6118	0.6118	0.0	4.7	O K
180 Winter	0.1	0.0	0.1	100.6573	0.6573	0.0	5.1	O K
240 Winter	0.1	0.0	0.1	100.6843	0.6843	0.0	5.3	O K
360 Winter	0.1	0.0	0.1	100.7118	0.7118	0.0	5.5	O K
480 Winter	0.1	0.0	0.1	100.7203	0.7203	0.0	5.6	O K
600 Winter	0.1	0.0	0.1	100.7188	0.7188	0.0	5.6	O K
720 Winter	0.1	0.0	0.1	100.7173	0.7173	0.0	5.5	O K
960 Winter	0.1	0.0	0.1	100.7073	0.7073	0.0	5.5	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	82.60	23
30 Summer	54.99	37
60 Summer	35.09	68
120 Summer	21.73	126
180 Summer	16.24	186
240 Summer	13.14	246
360 Summer	9.73	364
480 Summer	7.85	422
600 Summer	6.65	484
720 Summer	5.80	546
960 Summer	4.67	678
1440 Summer	3.44	956
2160 Summer	2.53	1368
2880 Summer	2.03	1764
4320 Summer	1.49	2556
5760 Summer	1.20	3336
7200 Summer	1.01	4040
8640 Summer	0.88	4760
10080 Summer	0.78	5544
15 Winter	82.60	23
30 Winter	54.99	37
60 Winter	35.09	66
120 Winter	21.73	124
180 Winter	16.24	182
240 Winter	13.14	240
360 Winter	9.73	352
480 Winter	7.85	458
600 Winter	6.65	550
720 Winter	5.80	574
960 Winter	4.67	726

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Summary of Results for 30 year Return Period (+20%)

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m^3)	Maximum Volume (m^3)	Status
1440 Winter	0.1	0.0	0.1	100.6723	0.6723	0.0	5.2	O K
2160 Winter	0.1	0.0	0.1	100.6123	0.6123	0.0	4.7	O K
2880 Winter	0.1	0.0	0.1	100.5563	0.5562	0.0	4.2	O K
4320 Winter	0.1	0.0	0.1	100.4632	0.4632	0.0	3.4	O K
5760 Winter	0.1	0.0	0.1	100.3902	0.3902	0.0	2.7	O K
7200 Winter	0.1	0.0	0.1	100.3317	0.3317	0.0	2.2	O K
8640 Winter	0.1	0.0	0.1	100.2852	0.2852	0.0	1.8	O K
10080 Winter	0.1	0.0	0.1	100.2472	0.2472	0.0	1.5	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
1440 Winter	3.44	1032
2160 Winter	2.53	1476
2880 Winter	2.03	1904
4320 Winter	1.49	2724
5760 Winter	1.20	3464
7200 Winter	1.01	4248
8640 Winter	0.88	4936
10080 Winter	0.78	5648

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Rainfall Details

Region	ENG+WAL	Cv (Summer)	0.750	Summer Storms	Yes
Return Period (years)	30	Cv (Winter)	0.840	Winter Storms	Yes
M5-60 (mm)	19.000	Shortest Storm (mins)	15	Climate Change %	+20
Ratio-R	0.350	Longest Storm (mins)	10080		

Time / Area Diagram

Total Area (ha) = 0.014

Time from:	(mins) to:	Area (ha)	Time from:	(mins) to:	Area (ha)
0	4	0.000	4	8	0.014

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Circular Pipe Details

Diameter (m) 0.900 Length (m) 9.000 Cover Level (m) 103.000
Slope (1:x) 500.0 Invert Level (m) 100.000

Hydro-Brake Outflow Control

Design Head (m) 0.918 Hydro-Brake Type MD6 Invert Level (m) 100.000
Design Flow (l/s) 0.1 Diameter (mm) 14

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	0.0	0.60	0.1	1.60	0.1	2.60	0.2	5.00	0.3	7.50	0.3
0.20	0.1	0.80	0.1	1.80	0.2	3.00	0.2	5.50	0.3	8.00	0.3
0.30	0.1	1.00	0.1	2.00	0.2	3.50	0.2	6.00	0.3	8.50	0.3
0.40	0.1	1.20	0.1	2.20	0.2	4.00	0.2	6.50	0.3	9.00	0.3
0.50	0.1	1.40	0.1	2.40	0.2	4.50	0.2	7.00	0.3	9.50	0.3

Weir / Flume Overflow Control

Discharge Coef 0.544 Width (m) 1.800 Crest Level (m) 100.918

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ARP ASSOCIATES
AND GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

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LS6 2QH
Tel: 0113 245 8498
Fax: 0113 244 3864
E-Mail: leeds@arpassociates.co.uk

Client: MR. D. TASKER		Project No. 800/71	Sheet. 6 of 10
Project: DANCE LANE, CRANE MOOR		Calc By. ARP	Date. 7/11/11
Element: PROPOSED DRAINAGE SOLUTIONS		Chkd By.	Date.

Discharge to Sewer

Impermeable Area for existing houses = 208 m^2
Impermeable Area for proposed houses = 142 m^2
Total Ip. 350 m^2

for a discharge rate of 2.9 l/s, and impermeable area of 350 m^2, and allowance for climatic change,

Attenuation for 1 in 30 year Storm

= 4.8 m^3.

This equates to 8 m of 0.9 m dia pipe or equivalent.

The computer output sheets from the WinDES Source Control computer program are presented on pages 7 - 10.

Summary of Results for 30 year Return Period (+20%)

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	2.3	0.0	2.3	100.5447	0.5447	0.0	3.7	O K
30 Summer	2.4	0.0	2.4	100.5967	0.5968	0.0	4.1	O K
60 Summer	2.4	0.0	2.4	100.5908	0.5907	0.0	4.1	O K
120 Summer	2.2	0.0	2.2	100.5167	0.5167	0.0	3.5	O K
180 Summer	2.2	0.0	2.2	100.4322	0.4322	0.0	2.8	O K
240 Summer	2.2	0.0	2.2	100.3477	0.3477	0.0	2.1	O K
360 Summer	2.2	0.0	2.2	100.2042	0.2042	0.0	1.0	O K
480 Summer	2.0	0.0	2.0	100.1348	0.1348	0.0	0.6	O K
600 Summer	1.9	0.0	1.9	100.0987	0.0988	0.0	0.4	O K
720 Summer	1.6	0.0	1.6	100.0868	0.0868	0.0	0.3	O K
960 Summer	1.3	0.0	1.3	100.0703	0.0703	0.0	0.2	O K
1440 Summer	1.0	0.0	1.0	100.0518	0.0517	0.0	0.1	O K
2160 Summer	0.7	0.0	0.7	100.0382	0.0382	0.0	0.1	O K
2880 Summer	0.6	0.0	0.6	100.0307	0.0307	0.0	0.1	O K
4320 Summer	0.4	0.0	0.4	100.0228	0.0227	0.0	0.0	O K
5760 Summer	0.3	0.0	0.3	100.0182	0.0183	0.0	0.0	O K
7200 Summer	0.3	0.0	0.3	100.0157	0.0158	0.0	0.0	O K
8640 Summer	0.3	0.0	0.3	100.0137	0.0138	0.0	0.0	O K
10080 Summer	0.2	0.0	0.2	100.0123	0.0123	0.0	0.0	O K
15 Winter	2.4	0.0	2.4	100.6178	0.6178	0.0	4.3	O K
30 Winter	2.5	0.0	2.5	100.6808	0.6808	0.0	4.8	O K
60 Winter	2.5	0.0	2.5	100.6568	0.6568	0.0	4.6	O K
120 Winter	2.3	0.0	2.3	100.5277	0.5277	0.0	3.6	O K
180 Winter	2.2	0.0	2.2	100.3947	0.3947	0.0	2.5	O K
240 Winter	2.2	0.0	2.2	100.2542	0.2542	0.0	1.4	O K
360 Winter	1.9	0.0	1.9	100.1127	0.1128	0.0	0.4	O K
480 Winter	1.6	0.0	1.6	100.0853	0.0853	0.0	0.3	O K
600 Winter	1.4	0.0	1.4	100.0723	0.0723	0.0	0.2	O K
720 Winter	1.2	0.0	1.2	100.0632	0.0633	0.0	0.2	O K
960 Winter	1.0	0.0	1.0	100.0508	0.0507	0.0	0.1	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	82.60	19
30 Summer	54.99	28
60 Summer	35.09	46
120 Summer	21.73	80
180 Summer	16.24	112
240 Summer	13.14	144
360 Summer	9.73	198
480 Summer	7.85	254
600 Summer	6.65	310
720 Summer	5.80	372
960 Summer	4.67	492
1440 Summer	3.44	738
2160 Summer	2.53	1080
2880 Summer	2.03	1472
4320 Summer	1.49	2160
5760 Summer	1.20	2840
7200 Summer	1.01	3632
8640 Summer	0.88	4280
10080 Summer	0.78	5128
15 Winter	82.60	19
30 Winter	54.99	29
60 Winter	35.09	48
120 Winter	21.73	84
180 Winter	16.24	118
240 Winter	13.14	148
360 Winter	9.73	196
480 Winter	7.85	250
600 Winter	6.65	310
720 Winter	5.80	370
960 Winter	4.67	494

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Summary of Results for 30 year Return Period (+20%)

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m^3)	Maximum Volume (m^3)	Status
1440 Winter	0.7	0.0	0.7	100.0378	0.0377	0.0	0.1	O K
2160 Winter	0.5	0.0	0.5	100.0277	0.0277	0.0	0.1	O K
2880 Winter	0.4	0.0	0.4	100.0222	0.0222	0.0	0.0	O K
4320 Winter	0.3	0.0	0.3	100.0163	0.0163	0.0	0.0	O K
5760 Winter	0.3	0.0	0.3	100.0133	0.0133	0.0	0.0	O K
7200 Winter	0.2	0.0	0.2	100.0113	0.0113	0.0	0.0	O K
8640 Winter	0.2	0.0	0.2	100.0098	0.0097	0.0	0.0	O K
10080 Winter	0.2	0.0	0.2	100.0088	0.0088	0.0	0.0	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
1440 Winter	3.44	740
2160 Winter	2.53	1104
2880 Winter	2.03	1448
4320 Winter	1.49	2152
5760 Winter	1.20	2768
7200 Winter	1.01	3800
8640 Winter	0.88	4232
10080 Winter	0.78	4880

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Rainfall Details

Region	ENG+WAL	Cv (Summer)	0.750	Summer Storms	Yes
Return Period (years)	30	Cv (Winter)	0.840	Winter Storms	Yes
M5-60 (mm)	19.000	Shortest Storm (mins)	15	Climate Change %	+20
Ratio-R	0.350	Longest Storm (mins)	10080		

Time / Area Diagram

Total Area (ha) = 0.035

Time from:	(mins) to:	Area (ha)	Time from:	(mins) to:	Area (ha)
0	4	0.000	4	8	0.035

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Circular Pipe Details

Diameter (m) 0.900 Length (m) 8.000 Cover Level (m) 103.000
Slope (1:x) 500.0 Invert Level (m) 100.000

Hydro-Brake Outflow Control

Design Head (m) 0.916 Hydro-Brake Type MD6 Invert Level (m) 100.000
Design Flow (l/s) 2.9 Diameter (mm) 73

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	1.9	0.60	2.4	1.60	3.9	2.60	5.0	5.00	6.9	7.50	8.4
0.20	2.2	0.80	2.7	1.80	4.1	3.00	5.3	5.50	7.2	8.00	8.7
0.30	2.0	1.00	3.1	2.00	4.3	3.50	5.7	6.00	7.5	8.50	9.0
0.40	2.1	1.20	3.4	2.20	4.6	4.00	6.1	6.50	7.8	9.00	9.2
0.50	2.2	1.40	3.6	2.40	4.8	4.50	6.5	7.00	8.1	9.50	9.5

Weir / Flume Overflow Control

Discharge Coef 0.544 Width (m) 1.800 Crest Level (m) 100.916

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