



## **FLOOD RISK ASSESSMENT**

ON  
**MOUNT VERNON HOSPITAL**  
**BARNSELEY**

ON BEHALF OF  
**SOUTH WEST YORKSHIRE PARTNERSHIP**  
**NHS FOUNDATION TRUST**

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**Flood Risk Assessment on Mount Vernon Hospital, Barnsley**

800/615r1

Revision/Date	Initial Issue 28 <sup>th</sup> November 2017	Revision A	Revision B	Revision C
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## **1.0 INTRODUCTION**

- 1.1 The South West Yorkshire Partnership NHS Foundation Trust is proposing to develop a parcel of land located at Mount Vernon Hospital, off Mount Vernon Road in Barnsley, South Yorkshire for residential dwellings. As part of the viability of the site and to supplement a planning application, it was decided that a Flood Risk Assessment Report should be undertaken.
- 1.2 It is within the general development strategy of the country for developments in areas where there is a risk of flooding to be assessed to avoid unnecessary increase in the requirement of flood defence. Under the National Planning Policy Framework (NPPF) and the accompanying Planning Practice Guidance (PPG), consultation is required with the Environment Agency, Land Drainage Authority and Water Authority and a Flood Risk Assessment Report should be prepared considering the development proposals and make recommendations for any flood mitigation measures.
- 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 the NPPF, to satisfy the requirements of the Planning Authority.
- 1.4 The consultations and walkover survey have been carried out between October and November 2017.
- 1.5 The report has been initially prepared for the use and reliance of the Client only. The report shall not be relied upon or transferred to any other parties without the written agreement of ARP Associates. For the avoidance of any doubt, where ARP Associates enters into a letter of reliance for the benefit of a third party, that third party will be permitted to rely on the report. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party without ARP Associates consent.

## **2.0 SITE DESCRIPTION**

### General

- 2.1 The site is currently a functioning hospital including areas of hardstanding, car parking and soft landscaping. The site is an irregular shaped piece of land with a total area of approximately 2.55ha. The site is centred on Ordnance Survey Grid Reference 434949, 404761.
- 2.2 A site location plan is presented in Appendix A.

### Current Use

- 2.3 The site is currently a functioning hospital with associated car parking and soft landscaping areas predominantly around the perimeter.

### Boundaries

- 2.4 The eastern boundary is formed by Mount Vernon Road with farmland further to the east. The majority of the northern boundary is formed by Coach House Lane, which is a private road providing access to private dwellings. Part of the northern and western boundary is formed by Worsbrough Common Primary School and playing fields. The southern boundary is against the residential property lines of dwellings served from Ridgewalk Way and the eastern boundary is in the form of a stone retaining wall against Mount Vernon Road. The site is located in the southern aspect of Barnsley, in a predominantly urban area, although there are arable fields to the east.

### Topography and Vegetation

- 2.5 The land is relatively flat with a high point in the northwest corner, with levels falling into the site. Along the southern boundary the land falls steeply to the south. The northwest corner is approximately 159m A.O.D. with the southeast corner at approximately 158m A.O.D. The site access falls to the east towards Mount Vernon Road. The site is close to a local high spot with levels falling steeply away in numerous directions. Land to the north is at a similar level to the site, with land to the west higher than the site. Land to the east and south is at a lower level.

- 2.6 Much of the site is taken up with hardstanding for car parking and the building footprints of Mount Vernon Hospital. However, there are large grassed areas between the buildings with several landscaped areas and sporadically located trees. There is a tree plantation along the southern portion of the site.
- 2.7 A topographical is not currently available.

#### Drainage

- 2.8 The existing buildings have positive drainage systems with rainwater downpipes discharging below ground. The existing drainage has not been investigated by CCTV and it is unknown where these downpipes discharge, however, it would be a fair assumption that it outfalls into the public sewer network. There are gullies present in the hardstanding areas on site and Linear Drainage systems present in parking areas.
- 2.9 The River Dearne is the closest main river, located approximately 2.15km to the north of the site. The nearest watercourse is approximately 515m to the east of the site known as Measborough Dike. This appears to be the head of the watercourse, which flows in a northerly direction towards the River Dearne.

### **3.0 ENVIRONMENT AGENCY CONSULTATION**

3.1 A consultation was requested from the Environment Agency (EA) and a copy of their response, reference RFI/2017/62954, dated 31<sup>st</sup> October 2017, is provided in Appendix B for reference.

3.2 The Environment Agency has provided a Flood Map, which shows areas of land that could flood from rivers or the sea and are shaded blue. These areas do not take into account defences as water can overtop or can fail in extreme conditions. The Zone classifications are:-

3.2.1 Flood Zone 1 - 'Low Probability' is assessed as having a less than 1 in 1,000 annual probability of river or sea flooding in any year (less than 0.1%).

3.2.2 Flood Zone 2 - 'Medium Probability' is assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding in any year (1% - 0.1%) and between a 1 in 200 and 1 in 1,000 annual probability of flooding from the sea (0.5% - 0.1%).

3.2.3 Flood Zone 3 - 'High Probability' is assessed as having a 1 in 100 or greater annual probability of river flooding in any year (greater than 1%) and a 1 in 200 chance or greater annual probability of flooding from the sea (less than 0.5%).

3.3 The EA flood map shows the site is located within Flood Zone 1.

3.4 The surface water flood map, shows areas where surface water only would be expected to flow or pond in England & Wales. All land in England and Wales will be within 'one' of a possible 'four' categories. The four categories shown on the map are:-

3.4.1 High - This area has a chance of flooding greater than 1 in 30 in any given year (annual probability of flooding 3.3%).

3.4.2 Medium - This area has a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%) in any given year.

3.4.3 Low - This area has a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) in any given year.

3.4.4 Very low - This area has a chance of flooding of less than 1 in 1000 (0.1%) in any given year.

3.5 The whole of the site is shown to be at a very low risk of surface water flooding.

#### **4.0 WATER AUTHORITY CONSULTATION**

- 4.1 A consultation was requested from Yorkshire Water, who is the Water Authority for this area and a copy of their response, reference R732985 dated 22<sup>nd</sup> October 2017 is presented in Appendix C for reference purposes.
- 4.2 Due to the change in legislation on the 1<sup>st</sup> October 2011, there may be public sewers within the site boundary which are not recorded on the statutory sewer map.
- 4.3 Development of the site should take place with separate systems for foul and surface water drainage.
- 4.4 Foul waster domestic waste should discharge to the 225mm diameter public combined sewer recorded in Mount Vernon Road, at a point to the east of the site.
- 4.5 In respect of surface water, reference is made to Requirement H3 of Building Regulations 2000 and Sustainable Drainage Systems. This establishes a hierarchy of surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order, before connection to sewer will be considered. Where appropriate, soakaways, swales and infiltration trenches (SuDS) may be adopted as part of the public sewer network.
- 4.6 If other methods of surface water disposal are not viable and subject to providing satisfactory evidence as to why they have discounted, curtilage surface water discharges to the public sewer will be restricted to the level of run-off, i.e. same rate of discharge - to that from the existing use of the site less a 30% reduction in the existing drainage. Any discharge of surface water from the site should discharge to similar points of connection to that of the existing use of the site. Demonstration of positive drainage based on a 1 in 1 year storm to the public sewer to Yorkshire Water by means of investigation and calculation needs to be carried out.

4.7 Yorkshire Water would require to see existing and proposed drainage layouts with pipe sizes, gradients and connection points. Measured impermeable areas of the present and proposed use of the site, along with the calculations that show the existing and proposed discharge rate from the site to the public sewer.

## **5.0 LAND DRAINAGE AUTHORITY CONSULTATION**

- 5.1 A consultation was requested from Barnsley Metropolitan District Council, who is the Land Drainage Authority for this area and a copy of their response, dated 20<sup>th</sup> October 2017 is presented in Appendix D for reference purposes.
- 5.2 It was confirmed that the Land Drainage Authority has no records of any culverted or open watercourses crossing the site indicated on the site location plan.
- 5.3 There is no knowledge of any part of the site being affected by floodplains from major watercourses in the area. As shown in Appendix D, the reference of flooding issues to gardens and outbuildings to properties on Acacia Grove, has been left in error from a previous enquiry and are to be ignored as they do not refer to this site.
- 5.4 There shall be no increase in surface water run-off from the new development. PPS25 recognises that the management of flood risk is not simply restricted to flood plains and that a catchment wide approach should be employed.
- 5.5 There are combined public sewers adjacent to the site and it was recommended that the Developer contact Yorkshire Water if they wish to discharge to sewers and discuss allowable discharge rates. It is recommended that a balancing facility would need to be designed to accommodate a 1 in 30 year flow from the site and 1 in 100 year flow retained within the site including an allowance for 30% for climate change, without causing any flooding to buildings. Alternative methods to conventional storage were recommended, providing ground conditions are suitable including sustainable urban drainage techniques, such as soakaways, permeable pavements, grassed swales, infiltration trenches, ponds and wetland to attenuate flood peak flows, produce water quality improvements and environmental enhancements.
- 5.6 The Authority seeks to promote the use of SuDS techniques to the site and expects the Developer of the site to submit detailed investigations such that the use of SuDS has been fully explored.

## 6.0 MATERIAL CONSIDERATION IN RESPECT OF NPPF AND PPG

### Flood Classification

- 6.1 The Environment Agency confirms that the site falls within Flood Zone 1, which is land assessed as having less than a 1 in 1,000 (less than 0.1%) annual probability of river flooding in any year. The proposed development site is, therefore, situated wholly within a 'low risk' area of fluvial flooding.

### End Use

- 6.2 The development proposal is for the construction of a substantial number of residential dwellings across the site. At the time of writing the report a site layout is not yet available.
- 6.3 When applying Table 2 of the PPG, the flood risk vulnerability classification shows that the proposed end use will fall into a "More Vulnerable" classification under the general classification "dwellings". With reference to NPPF, the citing of More Vulnerable development within Flood Zone 1 is deemed appropriate and assessment of other sites (the Sequential Test) is not deemed necessary.

### Flood Sources

- 6.4 Flooding from Rivers - There are no rivers maintained by the Environment Agency within the immediate vicinity of the site. An assessment of the Flood Map for planning confirms there is no flooding from any source of this type.
- 6.5 Flooding from Local Watercourses - There is an existing minor watercourse approximately 515m to the east, from the site boundary at its nearest point. This watercourse is at a significantly lower level than the site in the order of 30m lower.

- 6.6 Whilst no hydraulic modelling has been undertaken on this local beck to adequately quantify the flood risk emanating from this source, the proposed development site is known to be at a much higher level above the watercourse. Therefore, based on the elevational difference between the intervening topography, the risk of flooding from this source is considered to be low.
- 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 Environment Agency Surface Water Flood Map shows a very low surface water risk across the proposed development site, which is representative of the local topography as the site is close to the higher point of the area with levels in the vicinity of the site falling steeply away. Therefore, there is no risk of flooding considered from any higher ground or from this source.
- 6.9 Flooding from Groundwater - Whilst no intrusive ground investigation has been undertaken at the time of writing the report, the Geological Survey Map of Great Britain demonstrated that the site is likely to be underlain by Woolley Edge Rock comprised of sandstone. The geology is likely to be impermeable and less fractured, therefore, considering this with the topography of the surrounding area, flooding from this source is considered to be low risk.
- 6.10 Flooding from Sewer - There are existing sewers recorded adjacent to the site and there will also be a new drainage system for the development. It is possible, therefore, that any blockage of the sewers will result in flooding from the lowest cover level of manholes or gullies, and this will need to be considered as part of any proposed development.
- 6.11 Flooding from Reservoirs, Canals or Artificial Sources - The Environment Agency produce maps which show the expected inundation area should a reservoir fail and release its capacity. It should be noted, however, that reservoir flooding is extremely unlikely to happen and there has been no loss of life in the UK from reservoir flooding since 1925.

- 6.12 The proposed development site is shown to be outside of the maximum extent of reservoir flooding. There are no canals or other artificial sources within the vicinity of the proposed development site, therefore the risk from this source is deemed to be low.

#### Climate Change

- 6.13 The NPPF and PPG have indicated that the Global sea level will continue to rise, depending on greenhouse gas emissions, and the sensitivity of the climate system and there will be an increase in rainfall across the country.
- 6.14 United Kingdom climate change guidance was revised in February 2016 for peak river flows and peak rainfall intensities. With regards to peak river flows, a regionalised approach has now been adopted to climate change impacts based upon the river basin district of the proposed development site, the flood risk vulnerability of the proposed development and the present day Flood Zone classification.
- 6.15 The proposed development site is situated within the River Humber river basin district, which, based on an “upper end” climate change scenario, could see peak river flows increase by 50% by 2115. As the site is situated entirely within Flood Zone 1, an increase of 50% in river flows is deemed unlikely to affect the proposed development site.
- 6.16 In accordance with the revised climate change data, the published figures show that, for an expected life of greater than 50 years for any new development, the anticipated increase in rainfall could be up to 40%, subject to location within the country and the drainage system should be designed in accordance with this requirement. The Barnsley Metropolitan District Council flood risk requirements for managing on/off-site flood risk from fluvial flooding is to assess the development using a 30% allowance for climate change for the 1 in 100 year event at this location.
- 6.17 Due to the topography of the land and surrounding area, overland run-off from adjoining land is unlikely to be an issue. Therefore, any run-off from outside the site will be insignificant and, on this basis, only rainfall falling within the site boundaries will need to be considered in respect of climate change.

### Flood Mitigation

- 6.18 As the site falls within Flood Zone 1, flood mitigation measures are only required in the event of a catastrophic storm and blockage of the existing or proposed sewers. The following precautionary mitigation measures are, therefore, recommended:-
- 6.18.1 The finished floor levels to the properties shall be raised above external levels by a minimum of 150mm, wherever possible.
- 6.18.2 Properties shall be designed without any basements and ground floors shall comprise solid concrete slabs or beam and block with screed construction.
- 6.18.3 Incoming electricity supplies shall be raised above ground floor level and ground floor electric sockets shall be served by loops from the first floor level.
- 6.18.4 In the unlikely event of flooding on the site from a catastrophic storm, it would be appropriate to design external levels with falls to non-critical areas, such as landscaping, where the water can pond without causing flooding to buildings.
- 6.18.5 In the event of flooding of the site from any existing or proposed sewers, it will be necessary to ensure that there is a route for floodwater through the site without causing flooding of buildings.

### Sustainable Drainage

- 6.19 In order to comply with the requirements of NPPF, it will be necessary to consider aspects of Sustainable Drainage techniques for the new development. Whilst no investigation of the ground conditions have been carried out at the time of writing the report, the review of the Geological Survey Map of Great Britain shows the site to be underlain by Woolley Edge Rock comprised of sandstone. This material is likely to be impermeable and, therefore, unsuitable for the disposal of surface water using infiltration techniques. It will be necessary to carry out appropriate infiltration tests in accordance with BRE Digest 365

'Soakaway Design' prior to the construction on site and the results presented in a report for the approval of the Planning Authority. However, for the purpose of this report, a positive system to the public sewer system, located in Mount Vernon Road adjacent to the site will be required for surface water discharge, subject to agreement with the Regulatory Authorities.

#### Drainage

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

#### Existing Surface Water Run-Off

- 6.21 The site is assessed as being brownfield and in accordance with current Guidelines and Regulations, indicative surface water calculations have been undertaken using the modified Rational Method. The existing positively drained area has been determined to be 1.37ha as shown in the existing positively drained impermeable area plan presented in Appendix E. Therefore, the existing run-off from the site taking an average rainfall intensity of 50mm/hr, it is calculated as being as follows:-

$$Q = 2.78 \times CiA$$

$$Q = 2.78 \times 50 \times 1.37$$

$$Q = 190.43\text{l/s}$$

- 6.22 A reduction of 30% to comply with current guidance results in a proposed discharge rate of 133.30l/s.
- 6.23 A CCTV survey and assessment will need to be undertaken as part of the drainage strategy for the site with the discharge rate agreed with the Regulatory Authorities.

### Foul Drainage

- 6.24 Foul water domestic waste should discharge to the 225mm diameter public combined sewer recorded in Mount Vernon Road, at a point to the east of the site.

### Proposed Surface Water Drainage

- 6.25 Consideration of the proposed drainage should firstly be given to infiltration techniques (to ground). However, based on information available, the disposal of surface water using infiltration techniques may not be feasible. It will be necessary to carry out appropriate infiltration tests in accordance with BRE Digest 365 "Soakaway Design" prior to construction on-site and the results presented in a report for the approval of the Planning Authority.
- 6.26 There is a watercourse located approximately 515m to the east of the site, however, due to the distance from the site across third party land, any such connection is deemed impractical. Therefore, a positive drainage system to the existing public sewer adjacent to the site within Mount Vernon Road will be required for surface water drainage, subject to agreement with Yorkshire Water.
- 6.27 An assessment of the likely impermeable area has been made to assess the implications of surface water drainage from the development. Assuming that the proposed impermeable area will not be greater than 50% of the proposed site area for semi-detached and detached properties, calculations have been carried out using the WinDES Source Control Computer Program. The proposed surface water system should be designed to accommodate a 1 in 30 year storm event without flooding and a 1 in 100 year storm plus climate change event should be retained within the site in an area which will not affect the new buildings from flooding.
- 6.28 Restricting the discharge rate to no greater than 133.3l/s, based on a proposed impermeable area of approximately 1.28ha on-site storage of 121.9m<sup>3</sup> will need to be provided for a 1 in 30 year storm. This can be achieved by several methods including

oversized pipes, underground tanks or detention basins. The drainage system will also need to accommodate the 1 in 100 year plus 30% for climate change event without causing flooding of property or third party land. In the event that levels dictate that the 1 in 100 year plus climate change flood water will flow off-site, an additional or larger storage facility will be required. Therefore, on-site storage would increase to 289.1m<sup>3</sup>. The indicative surface water calculations are presented in Appendix F. However, detailed calculations and proposals will need to be prepared and submitted to the Planning Authority for approval prior to construction.

#### Emergency Egress During Times of Flood

- 6.29 It is a requirement under the PPG that occupants should be able to egress any building during times of flood, without being trapped by flood conditions.
- 6.30 As the site falls within Flood Zone 1, no special mitigation measures are required for emergency egress during times of flood.

## 7.0 COMMENTS

- 7.1 The site falls within Flood Zone 1 and the Sequential Test is satisfied. However, in order to accommodate the possibilities of flood from a catastrophic storm or blockage of the existing or proposed sewers, the following precautionary mitigation measures are recommended:-
- 7.1.1 The finished floor levels to the properties shall be raised above external levels by a minimum of 150mm, wherever possible.
  - 7.1.2 Properties shall be designed without any basements and ground floors shall comprise solid concrete slabs or beam and block with screed construction.
  - 7.1.3 Incoming electricity supplies shall be raised above ground floor level and ground floor electric sockets shall be served by loops from the first floor level.
  - 7.1.4 In the unlikely event of flooding on the site from a catastrophic storm, it would be appropriate to design external levels with falls to non-critical areas, such as landscaping, where the water can pond without causing flooding to buildings.
  - 7.1.5 In the event of flooding of the site from any existing or proposed sewers, it will be necessary to ensure that there is a route for floodwater through the site without causing flooding of buildings.
- 7.2 A 30% increase in rainfall shall be incorporated into any new positive drainage system to satisfy the requirements of climate change.
- 7.3 Sustainable Drainage Systems of infiltration techniques are considered to be unsuitable on this particular site and for the purpose of the report a positive drainage system will be required. However, infiltration testing will need to be carried out in accordance with BRE Digest 365 "Soakaway Design" prior to construction on site and the results will be reported to the Planning Authority for approval.

- 7.4 The proposed surface water drainage system shall be designed for an allowance for climate change and restricted to the agreed discharge rate with appropriate attenuation incorporated into the design. A detailed design and calculations shall be submitted to the Planning Authority for approval prior to construction on site.
- 7.5 The discharge of the surface water will require the consent of Yorkshire Water and Barnsley Metropolitan District Council as Lead Local Flood Authority.
- 7.6 Foul water domestic waste should discharge to the 225mm diameter public combined sewer recorded in Mount Vernon Road at a point to the east of the site.
- 7.7 No special mitigation measures are required for emergency egress during times of flood.
- 7.8 Subject to compliance with the above, the proposed development can satisfy the requirements of the National Planning Policy Framework and the Planning Practice Guidance in relation to flood risk.

**APPENDIX A**

**SITE LOCATION PLAN**



All levels to GPS

OS Grid Reference: SE 349 047

Rev	By	Date	Amendment	Chk
/	JMG	10.10.17	Issued for approval	PSC

Title  
SITE LOCATION PLAN

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Scale	1:5000 @ A4	Drawn	JMG
Date	OCT 17	Chk.	PSC
Drg. No.	800/615/NA	Rev	/

Project/Client  
 MOUNT VERNON HOSPITAL, BARNSELEY  
 SOUTH WEST YORKSHIRE PARTNERSHIP

H.M. LAND REGISTRY		TITLE NUMBER	
		SYK 326399	
ORDNANCE SURVEY PLAN REFERENCE	SE3404NE SE3504NW	SECTION	Scale 1/1250
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**A P P E N D I X B**

**E N V I R O N M E N T A G E N C Y C O N S U L T A T I O N**

## Paul Carter

---

**From:** Glenton, Rob <Rob.Glenton@environment-agency.gov.uk>  
**Sent:** Tuesday 31 October, 2017 12:47 pm  
**To:** Paul Carter  
**Subject:** Your Enquiry: RFI/2017/62954  
**Attachments:** flood risk & flood consequence assessments.pdf; Flood Map for Planning RFI 62954.pdf; Risk of Flooding from Surface Water RFI 62954.pdf; Asset Information RFI 62954.pdf; Asset Location Map RFI 62954.pdf

**Our Ref:** RFI/2017/62954

Dear Paul

### **Provision of Product 4 for Mount Vernon Hospital, Barnsley**

Thank you for your request of 10 October 2017 to use Environment Agency data, Product 4, in the development of the FRA. The information is attached.

If you have requested this information to help inform a development proposal, then you should note the detail in the attached advisory text on the use of Environment Agency Information for Flood Risk Assessments.

### **Supporting Information**

#### **The Flood Map for Planning**

The Environment Agency provides the Flood Map (see enclosed extract).

What is the Flood Map for Planning?

The Flood Map for Planning provides information on flooding from rivers and the sea for England and Wales. The Flood Map also has information on flood defences and the areas benefiting from those flood defences.

The Flood Map for Planning shows the following:

1. Flood Zone 3 (dark blue area on the enclosed map): natural flood plain area that could be affected by flooding from rivers and/or the sea – not taking into account the presence of any flood defences
  - For flooding from rivers the map indicates the extent of a flood with a 1% (1 in 100) chance of happening each year;
  - For flooding from the sea the map shows the extent of a flood with a 0.5% (1 in 200) chance of happening each year.
2. Flood Zone 2 (light blue area): natural flood plain area that could be affected by flooding from rivers and/or the sea – not taking into account the presence of any flood defences. Flood Zone 2:
  - indicates the extent of a flood with a 0.1% (1 in 1000) chance of happening each year.
  - and/or indicates the greatest recorded historic flood, whichever is greater.
3. Flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, together with some natural or constructed entities which retain, store or channel water and which may protect against smaller floods.
4. Areas benefiting from flood defences - areas that benefit from the flood defences shown, in the event of a river flood with a 1% (1 in 100) chance of happening each year, or a flood from the sea with a 0.5% (1 in 200) chance of happening each year. If the defences were not there, these areas would flood.

## **Flood History**

### **Flood History – None available**

To the best of our knowledge there is no known flood history for this site. The extent of flooding, and/or flood level information is only shown for those watercourses surveyed after the flood. Other flooding may have occurred which is not shown. This is the best information currently available. For local drainage information please contact your water utility company and your local council.

Water causing flooding can come from different places, for example from rivers or the sea; surface water (i.e. rainwater flowing over or accumulating on the ground before it is able to enter rivers or the drainage system); overflowing or backing up of sewers or drainage systems which have been overwhelmed or from groundwater rising up from underground aquifers.

Currently the Environment Agency can only supply flood risk data relating to the risk of flooding from rivers or the sea. However you should be aware that in recent years, there has been an increase in flood damage caused by surface water flooding or drainage systems that have been overwhelmed. Local Authorities and/or Water Companies may be able to provide some knowledge on the risk of flooding from sources other than rivers and the sea and we are working with these organisations to improve knowledge and understanding of surface water flooding.

## **Assets**

### **Asset Location Map**

Please find attached asset map(s) showing location of all (Agency and non Agency maintained) flood defences and channels.

### **Description of Works**

See attached table with description of the defences and structures shown on the above drawing, including condition ratings, upstream and downstream crest levels, where available.

### **Risk of Flooding – Environment Agency Defences**

The risk of flooding in this area is now reduced by the presence of flood defences that we maintain, but there still is a residual risk of flooding if these were to breach or be overtopped by a flood greater than that for which they were designed.

### **Risk of Flooding – Privately Maintained Defences**

You will see that the Environment Agency does not maintain any of those defences. However we undertake regular risk based visual inspections. We do not hold design levels and have no height information on these defences or structures.

### **Asset Condition Ratings**

The performance of a flood defence asset is recorded as the condition of the asset. Our asset inspectors subjectively assess the conditions of assets (during visual inspection site visits) with reference to a national standard template. Each asset is given a rating between one and five with one being very good condition and five being very poor. A condition rating of 3, or 'fair' is the minimal acceptable standard for a critical asset, such as a defence wall that protects properties. We are striving to improve all assets below 'fair' to an acceptable standard.

Asset inspections are done on average every six months, although some critical assets are assessed on a more regular basis. It is possible that adjacent assets are inspected on different dates, which may result in two assets of a similar state of repair having different condition ratings.

Condition ratings of assets may also be affected by the time of year the surveys are conducted, as vegetation may obscure the asset in the summer months, or accessibility may be an issue during winter months. These factors would not usually affect the recorded condition rating of an asset unless the asset is on a borderline between two ratings.

## **Asset Standard of Protection**

Please note that the provided Design Standard of Protection is an estimate and should not be relied on. Please note that where available the defended flood extents provide more reliable information relating to the protection offered by the defence (i.e. at which return period the water levels are likely to overtop the defence). If available and required the defended flood extents can be provided on request.

## **Modelling**

### **Modelling Information**

We do not have any modelling information at this location.

### **Climate Change**

Please note that new guidance on climate change allowances for Flood Risk Assessments has been published in February 2016.

The new guidelines are available from:

<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

## **Other**

### **Surface Water Map**

#### **Risk of flooding from surface water information for Mount Vernon Road, Barnsley, S70 4EU**

Thank you for your enquiry dated 10<sup>th</sup> October 2017 regarding the above location.

Enclosed is a map of showing the risk of flooding from surface water for this area, produced in partnership with Local Authorities.

Surface water flood risk is widely distributed and can happen far from rivers and the sea. It's sometimes hard to say whether you're in an area at risk of flooding from surface water because surface water flooding can follow many more paths and can be affected by very small features such as kerb height and even speed bumps. We recommend you consider not only whether your property is shown in or near an area at risk, but also the broader scale and pattern of surface water flooding shown in your area. You may also wish to view this and other flood risk maps on our website.

Whether your property is at risk will depend on the accuracy of the mapping in this area, and on the details of your property – for example, how waterproof the structure is, the levels of doors and airbricks, and whether you have installed any flood resilience measures such as airbrick covers and flood boards.

If you require information on what is being done to manage surface water flood risk in your local area, please contact Barnsley Metropolitan District Council.

### **Information Warning**

Please note:

It is not possible to say for certain what the flood risk is but we use the best information available to provide an indication so that people can make informed choices about living with or managing the risks. The information we supply does not provide an indicator of flood risk at an individual property / site level.

The flood risk information provided on the attached map does not cover other sources of flooding such as from rivers and sea.

### **Risk of Flooding from Reservoirs Map**

Outlines and simplified depth and velocity maps can be viewed on our website:

<http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=reservoir&scale=1&textonly=off&ep=map&layerGroups=default&lang=e&y=355134&x=357683#x=438988&y=406600&scale=2>

Please, zoom into the location of interest, and then click on the inundated location for details. As a result a list of reservoirs will be provided with supporting information and a links to other data, such as estimated depths and speed of flooding, at the bottom of the result page.

A map of showing the outlines can also be provided on request.

### **Flood Warning**

The site is covered by a Flood Warning. To register to receive this service, you can call Floodline 24 hours a day on 0845 988 1188.

### **LIDAR Data**

Please note that our LiDAR data is now available free of charge (Open Data) from <http://environment.data.gov.uk/ds/survey/index.jsp#/survey> (once zoomed to the relevant location the available LiDAR products will be listed below the map).

Two LIDAR products are available:

1. Tiled LIDAR data - The full tiled dataset consists of historic LIDAR data which has been gathered since 1998. For some areas we have carried out repeat surveys and data is available in a range of resolutions.
2. Composite LIDAR data - The composite dataset is derived from a combination of our full tiled dataset which has been merged and re-sampled to give the best possible spatial coverage.

Light Detection and Ranging (LIDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground. This technique results in the production of an accurate, cost-effective terrain model suitable for assessing flood risk and other environmental applications.

The Environment Agency owns two LIDAR systems, which are installed in a survey aircraft along with its other operational remote sensing instruments.

The aircraft is positioned and navigated using Global Positioning System (GPS) corrected to known ground reference points. The aircraft typically flies at a height of about 800 metres above ground level and a scanning mirror allows a swath width of about 600 metres to be surveyed during a flight.

### **The Rights & Responsibilities of a Riverside Owner**

The owner of property adjacent to a watercourse is usually deemed to be the riparian owner and, as such, has both riparian rights and responsibilities with regard to the watercourse within their ownership.

The responsibility for general maintenance and repair of the watercourse and its banks rests with the riparian owner. For more information on Rights and Responsibilities of a riverside owner, you can visit our website at: <https://www.gov.uk/government/organisations/environment-agency> go to the Flooding and coastal change section and click on 'Riverside ownership: rights and responsibilities ('living on the edge') under the River maintenance section and download the 'Living on the Edge' booklet.

Alternatively type the following address into your web browser:

<https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities>

### **Ordnance Survey Data**

Under the terms of our licence agreement with the Ordnance Survey, we are unable to supply the OS data. Under this agreement we can only supply OS data to consultants/contractors carrying out work on our behalf.

### **Flood Portal**

It's a new 'one-stop shop' web portal providing guidance and information on flood risk management in the UK. Arup have written and designed the site, in conjunction with CIRIA, the Local Government Association, the EA and Defra,

primarily as a resource for local authority officers, flood risk management professionals, and others with an interest in flood risk. It's a part of the Capacity Building Strategy.

<http://www.local.gov.uk/floodportal>

This information is provided subject to the Open Government Licence ([here](#)) - please read for details of permitted use.

If you have any queries or would like to discuss the content of this letter further please contact us on the telephone number below.

**We would be really grateful if you could spare five minutes to help us improve our service. Please click on the link below and fill in our survey – we use every piece of feedback we receive:**

<http://www.smartsurvey.co.uk/s/EnvironmentAgencyCustomerSurvey/?a=Y>

Yours sincerely,

Rob

**Rob Glenton | Customers and Engagement Team**

**Environment Agency** | Lateral, 8 City Walk, Leeds, LS11 9AT

Enquiries Team Tel: 0208 474 8174 | Email: [neyorkshire@environment-agency.gov.uk](mailto:neyorkshire@environment-agency.gov.uk)

Direct Tel: 0208 474 9815 | Email: [rob.glenton@environment-agency.gov.uk](mailto:rob.glenton@environment-agency.gov.uk)

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# RFI: 62954 Flood Map for Planning for Mount Vernon Road, Barnsley Date Created: 24/10/17



www.environment-agency.gov.uk




Scale: 1:10,000



when reproduced @ A3



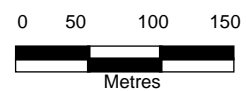
## LEGEND

-  Main River
-  Flood Zone 2 (FZ2)
-  Flood Zone 3 (FZ3)



Legend

- Flood Extent 1 in 30
- Flood Extent 1 in 100
- Flood Extent 1 in 1000



## Use of Environment Agency Information for Flood Risk / Flood Consequence Assessments

### **Important**

If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:-

<http://www.environment-agency.gov.uk/research/planning/33580.aspx>

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In **England**, you should refer to the Environment Agency's Flood Risk Standing Advice, the technical guidance to the National Planning Policy Framework and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

<http://www.environment-agency.gov.uk/research/planning/82587.aspx>

<http://www.communities.gov.uk/publications/planningandbuilding/nppftechnicalguidance>

<http://www.communities.gov.uk/publications/planningandbuilding/pps25guideupdate>

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

In **Wales**, you should refer to TAN15 for information about what flood consequence assessment is needed for new development in the different flood zones

<http://new.wales.gov.uk/splash;jsessionid=8ylGTfGZthmB0t2vhp6hS1GcB1LXvZzB3Ylczf20Xn7LK3zk0nMk!981825250?orig=/topics/planning/policy/tans/tan15/>

You should also consult the Strategic Flood Consequence Assessment if one has been produced by your local planning authority.

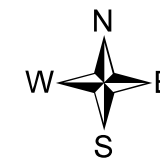
In both **England and Wales** you should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk / Consequence Assessment (FRA / FCA) where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.
3. Where a planning application requires a FRA / FCA and this is not submitted or deficient, the Environment Agency may well raise an objection.
4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.



www.environment-agency.gov.uk

Scale: 1:10,000



when reproduced @ A3

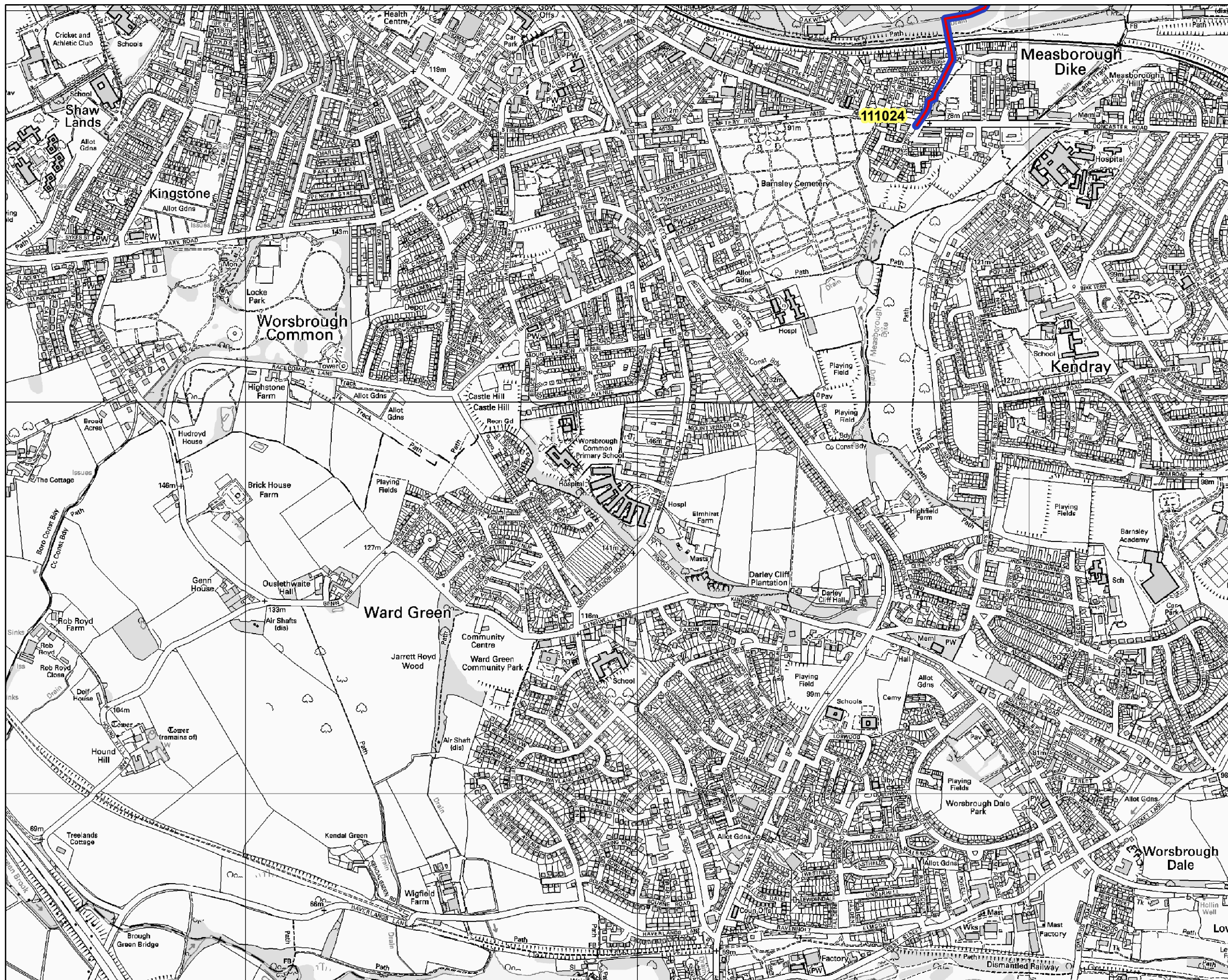


LEGEND

 Main River

Assets

 111024



**RFI No: 62954 Asset Information**

<b>Asset ID</b>	<b>Asset Type</b>	<b>Asset Subtype</b>	<b>Maintainer</b>	<b>Description</b>	<b>Bank</b>	<b>Design Standard of Protection (yrs)</b>	<b>Actual Downstream Crest Level (mAOD)</b>	<b>Actual Upstream Crest Level (mAOD)</b>	<b>Actual Condition Rating</b>
111024	Channel	Simple Culvert	Private	Culvert		30			5

**APPENDIX C**

**WATER AUTHORITY CONSULTATION**



YorkshireWater

Mr P Carter  
Arp Associates  
Unit 5/6 Northwest Business Pk  
1ST FLR Servia Hill  
Woodhouse  
Leeds  
LS6 2QH

Yorkshire Water Services  
Developer Services  
Sewerage Technical Team  
PO BOX 52  
Bradford  
BD3 7AY

Tel: 0345 120 8482  
Fax: (01274) 372 834

Your Ref: ARP013 800/615  
Our Ref: T017671

Email:  
Technical.Sewerage@yorkshirewater.co.uk

For telephone enquiries ring:  
Chris Roberts on 0345 120 8482

22nd October 2017

Dear Mr Carter,

**Land At Mount Vernon Hospital Mount Vernon Road Worsborough Barnsley S70 4EU - Pre Planning Sewerage Enquiry On R732985**

Thank you for your recent enquiry. Our charge of £153.00 (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 which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records. The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months.

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

**Foul Water**

Foul water domestic waste should discharge to the 225 mm diameter public combined sewer recorded in Mount Vernon Road, at a point to the east of the site.

**Surface Water**

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 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.

If other methods of surface water disposal are not viable and subject to providing satisfactory evidence as to why they have been discounted, curtilage surface water discharges to the public sewer will be restricted to the level of run-off - i.e. same rate of discharge - to that from the existing use of the site less a 30% reduction in the existing discharge. Any discharge of surface water from the site should discharge





to similar points of connection to that of the existing use of the site. You will need to demonstrate positive drainage, based on a 1 in 1 year storm, to the public sewer to Yorkshire Water by means of investigation and calculation carried out at your expense.

To do this, Yorkshire Water requires to see existing and proposed drainage layouts with pipe sizes, gradients and connection points, measured impermeable areas of the present and proposed use of the site, along with the calculations that show the existing and proposed discharge rate from the site to the public sewer.

**Other Observations**

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may obtain an application form from our website ([www.yorkshirewater.com](http://www.yorkshirewater.com)) or by telephoning 0345 120 84 82.

An off-site foul and 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 0345 120 84 82 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 0345 120 84 82.

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 sincerely

**Chris Roberts**  
**Sewerage Technician**  
**Developer Services**



434756 : 404599

Map Name : SE3404NE

Title

Partial Key



Yorkshire Water,  
 PO Box 500,  
 Halifax Road,  
 Bradford BD6 2LZ  
 Contact Name :  
 YorMap Advisor C ROBERTS  
 Contact Tel : 87 2582

Notes

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- Foul Sewer = F
- Combined Sewer = C
- Surface Water Sewer = SW
- Trade Sewer = TD
- Partially Separate = PS

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 connections are shown.

Date Req : 22/10/2017, 10:50:43

Date Gen : 22/10/2017, 10:51:28

Source : Sewer Network Enquiry

**APPENDIX D**

**LAND DRAINAGE AUTHORITY CONSULTATION**

## Paul Carter

---

**From:** Atkins , Wayne <WayneAtkins@barnsley.gov.uk>  
**Sent:** Friday 20 October, 2017 9:52 am  
**To:** Paul Carter  
**Cc:** Wayne Walker  
**Subject:** RE: 800/615: Mount Vernon Hospital, Barnsley - Pre Planning Enquiry

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

The Council have no records of any culverted or open watercourses crossing the site indicated on your plan.

I would confirm that to my knowledge it is not affected by any flood plains from major watercourses in the area, however, I am aware of flooding issues to gardens and outbuildings to properties on Acacia Grove which are believed to be caused by run off from the site in question.

The developer's attention is drawn to the following:

There should be no increase in surface water runoff from the new development. PPS25 recognises that the management of flood risk is not simply restricted to flood plains and that a catchment-wide approach should be employed.

There are foul and surface water public sewers adjacent to the site. The developer should contact Yorkshire Water if they wish to discharge to this sewer to discuss allowable discharge rates.

Any balancing facility should be designed to accommodate a 1 in 30 year flow from the site and a 1 in 100 year flow retained within the site (including an allowance of 30% for climate change), without causing any flooding to buildings.

There are alternatives to conventional storage for the control of surface water run-off that are favoured by the authority where ground conditions are suitable. Sustainable Urban Drainage techniques (SUD's) 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.

The authority seeks to promote the use of SUD's techniques to this site and the authority expects the developer of the site to submit detailed investigations such that the use of SUD's has been fully explored. The Authority has a policy of not adopting SUDs features unless they are specifically designed to drain adoptable Highways only. The developer should explore other avenues for adoption e.g. Yorkshire Water.

Wayne Atkins  
Principal Engineer – Drainage  
Environment & Transport  
Place Directorate  
Barnsley Metropolitan Borough Council

Telephone: 01226 772182  
E-mail: wayneatkins@barnsley.gov.uk

---

**From:** Paul Carter [mailto:PaulCarter@arpassociates.co.uk]  
**Sent:** 10 October 2017 14:54  
**To:** Atkins , Wayne  
**Cc:** Wayne Walker  
**Subject:** 800/615: Mount Vernon Hospital, Barnsley - Pre Planning Enquiry

## Paul Carter

---

**From:** Atkins , Wayne <WayneAtkins@barnsley.gov.uk>  
**Sent:** Monday 27 November, 2017 8:02 am  
**To:** Paul Carter  
**Subject:** RE: 800/615: Mount Vernon Hospital, Barnsley - Pre Planning Enquiry

Hi Paul,

My apologies, this reference has been left in in error from a previous enquiry, please ignore. Would you like me to send you a revised email or are you OK with this?

Cheers

Wayne Atkins  
Principal Engineer – Drainage  
Environment & Transport  
Place Directorate  
Barnsley Metropolitan Borough Council

Telephone: 01226 772182  
E-mail: wayneatkins@barnsley.gov.uk

---

**From:** Paul Carter [mailto:PaulCarter@arpassociates.co.uk]  
**Sent:** 17 November 2017 09:29  
**To:** Atkins , Wayne  
**Subject:** RE: 800/615: Mount Vernon Hospital, Barnsley - Pre Planning Enquiry

Good Morning Wayne,

Thank you for your response below. I just have a quick query please – you refer to “Acacia Grove”, however, I cannot find such a street in the vicinity of Mount Vernon Hospital. Please can you confirm if this street is close to the site?

Thank you,

Kind Regards

Paul Carter  
0113 245 8498  
[paulcarter@arpassociates.co.uk](mailto:paulcarter@arpassociates.co.uk)



**ARP ASSOCIATES &  
ARP GEOTECHNICAL LTD**

[www.arpassociates.co.uk](http://www.arpassociates.co.uk)

5 & 6 Northwest Business Park, Servia Hill, Leeds LS6 2QH  
Pre-planning Geotechnical Civil Engineering Structural Engineering

**APPENDIX E**

**EXISTING POSITIVELY DRAINED IMPERMEABLE AREA PLAN**



Coach House Ln

Mount Vernon Rd

Mount Vernon Hospital

Mount Vernon Rd


Mount Vernon Rd

Elmhirst Farm

800/615  
MOUNT VERNON HOSPITAL,  
BARNSELY.  
EXISTING POSITIVELY  
DRAINED AREA PLAN  
AREA ≈ 1.37ha

## **APPENDIX F**


### **INDICATIVE SURFACE WATER DRAINAGE CALCULATIONS**

ARP Associates		Page 1
Northwest House Servia Hill Leeds LS6 2QH	Mt Vernon Hospital Barnsley	
Date 22/11/2017 12:30pm File 800615 lin30.srcx	Designed by PSC Checked by WMW	
Elstree Computing Ltd		Source Control 2017.1.2

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	8.571	0.671	133.0	102.4	O K
30 min Summer	8.638	0.738	133.0	112.7	O K
60 min Summer	8.568	0.668	133.0	102.0	O K
120 min Summer	8.380	0.480	131.6	73.3	O K
180 min Summer	8.285	0.385	121.8	58.7	O K
240 min Summer	8.240	0.340	103.3	52.0	O K
360 min Summer	8.188	0.288	79.9	43.9	O K
480 min Summer	8.156	0.256	65.9	39.0	O K
600 min Summer	8.134	0.234	56.5	35.7	O K
720 min Summer	8.117	0.217	49.5	33.1	O K
960 min Summer	8.093	0.193	40.2	29.5	O K
1440 min Summer	8.064	0.164	29.9	25.0	O K
2160 min Summer	8.039	0.139	22.0	21.2	O K
2880 min Summer	8.024	0.124	17.7	18.9	O K
4320 min Summer	8.005	0.105	13.0	16.0	O K
5760 min Summer	7.994	0.094	10.4	14.3	O K
7200 min Summer	7.986	0.086	8.8	13.1	O K
8640 min Summer	7.980	0.080	7.6	12.2	O K
10080 min Summer	7.975	0.075	6.8	11.5	O K
15 min Winter	8.658	0.758	132.9	115.7	O K
30 min Winter	8.699	0.799	133.2	121.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	68.836	0.0	165.0	13
30 min Summer	45.828	0.0	219.8	22
60 min Summer	29.238	0.0	280.6	38
120 min Summer	18.112	0.0	347.6	68
180 min Summer	13.534	0.0	389.7	96
240 min Summer	10.952	0.0	420.4	126
360 min Summer	8.106	0.0	466.8	186
480 min Summer	6.544	0.0	502.4	246
600 min Summer	5.539	0.0	531.6	308
720 min Summer	4.832	0.0	556.5	368
960 min Summer	3.892	0.0	597.7	490
1440 min Summer	2.866	0.0	660.2	734
2160 min Summer	2.108	0.0	728.3	1100
2880 min Summer	1.693	0.0	780.0	1464
4320 min Summer	1.242	0.0	858.2	2188
5760 min Summer	0.996	0.0	917.8	2920
7200 min Summer	0.839	0.0	966.4	3640
8640 min Summer	0.730	0.0	1008.5	4360
10080 min Summer	0.648	0.0	1045.6	5056
15 min Winter	68.836	0.0	184.8	14
30 min Winter	45.828	0.0	246.2	23

ARP Associates		Page 2
Northwest House Servia Hill Leeds LS6 2QH	Mt Vernon Hospital Barnsley	
Date 22/11/2017 12:30pm File 800615 lin30.srcx	Designed by PSC Checked by WMW	
Elstree Computing Ltd		Source Control 2017.1.2

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
60 min Winter	8.550	0.650	133.0	99.2	O K
120 min Winter	8.296	0.396	126.1	60.5	O K
180 min Winter	8.229	0.329	98.2	50.2	O K
240 min Winter	8.189	0.289	80.6	44.2	O K
360 min Winter	8.143	0.243	60.5	37.1	O K
480 min Winter	8.115	0.215	48.9	32.9	O K
600 min Winter	8.096	0.196	41.5	30.0	O K
720 min Winter	8.082	0.182	36.3	27.8	O K
960 min Winter	8.062	0.162	29.4	24.8	O K
1440 min Winter	8.038	0.138	21.7	21.0	O K
2160 min Winter	8.017	0.117	16.0	17.9	O K
2880 min Winter	8.004	0.104	12.8	15.9	O K
4320 min Winter	7.989	0.089	9.4	13.5	O K
5760 min Winter	7.979	0.079	7.5	12.1	O K
7200 min Winter	7.973	0.073	6.4	11.1	O K
8640 min Winter	7.968	0.068	5.6	10.3	O K
10080 min Winter	7.964	0.064	4.9	9.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
60 min Winter	29.238	0.0	314.3	40
120 min Winter	18.112	0.0	389.4	68
180 min Winter	13.534	0.0	436.5	96
240 min Winter	10.952	0.0	470.9	126
360 min Winter	8.106	0.0	522.8	188
480 min Winter	6.544	0.0	562.7	248
600 min Winter	5.539	0.0	595.4	308
720 min Winter	4.832	0.0	623.3	368
960 min Winter	3.892	0.0	669.5	490
1440 min Winter	2.866	0.0	739.4	734
2160 min Winter	2.108	0.0	815.7	1096
2880 min Winter	1.693	0.0	873.7	1428
4320 min Winter	1.242	0.0	961.2	2152
5760 min Winter	0.996	0.0	1028.0	2928
7200 min Winter	0.839	0.0	1082.4	3600
8640 min Winter	0.730	0.0	1129.5	4344
10080 min Winter	0.648	0.0	1171.1	5112

ARP Associates		Page 3
Northwest House Servia Hill Leeds LS6 2QH	Mt Vernon Hospital Barnsley	
Date 22/11/2017 12:30pm File 800615 lin30.srcx	Designed by PSC Checked by WMW	
Elstree Computing Ltd		Source Control 2017.1.2


Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.280

<b>Time (mins)</b>		<b>Area</b>
<b>From:</b>	<b>To:</b>	<b>(ha)</b>
0	4	1.280

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 7.900

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	152.7	0.700	152.7	1.400	152.7	2.100	152.7
0.100	152.7	0.800	152.7	1.500	152.7	2.200	152.7
0.200	152.7	0.900	152.7	1.600	152.7	2.300	152.7
0.300	152.7	1.000	152.7	1.700	152.7	2.400	152.7
0.400	152.7	1.100	152.7	1.800	152.7	2.500	152.7
0.500	152.7	1.200	152.7	1.900	152.7		
0.600	152.7	1.300	152.7	2.000	152.7		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0450-1333-0800-1333
Design Head (m)	0.800
Design Flow (l/s)	133.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	450
Invert Level (m)	7.900
Minimum Outlet Pipe Diameter (mm)	500
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	133.3
Flush-Flo™	0.576	133.0
Kick-Flo®	0.749	129.0
Mean Flow over Head Range	-	91.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	11.8	1.200	162.4	3.000	254.2	7.000	385.5
0.200	43.0	1.400	175.1	3.500	274.2	7.500	398.8
0.300	85.4	1.600	186.9	4.000	292.7	8.000	411.7
0.400	127.5	1.800	197.9	4.500	310.2	8.500	418.8
0.500	132.1	2.000	208.4	5.000	326.7	9.000	431.3
0.600	132.9	2.200	218.4	5.500	342.4	9.500	443.4
0.800	133.3	2.400	227.9	6.000	357.3		
1.000	148.6	2.600	237.0	6.500	371.7		

Northwest House  
 Servia Hill  
 Leeds LS6 2QH

Mt Vernon Hospital  
 Barnsley



Date 22/11/2017 12:22pm  
 File 800615 1IN100 PLUS 30.SRCX

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Source Control 2017.1.2

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	8.478	0.578	133.0	210.3	O K
30 min Summer	8.590	0.690	133.0	250.7	O K
60 min Summer	8.631	0.731	133.0	265.9	O K
120 min Summer	8.559	0.659	133.0	239.4	O K
180 min Summer	8.455	0.555	133.0	201.7	O K
240 min Summer	8.371	0.471	131.3	171.4	O K
360 min Summer	8.280	0.380	119.9	137.9	O K
480 min Summer	8.236	0.336	101.5	122.2	O K
600 min Summer	8.206	0.306	88.2	111.3	O K
720 min Summer	8.184	0.284	78.2	103.1	O K
960 min Summer	8.152	0.252	64.1	91.6	O K
1440 min Summer	8.113	0.213	48.1	77.4	O K
2160 min Summer	8.080	0.180	35.4	65.3	O K
2880 min Summer	8.059	0.159	28.4	58.0	O K
4320 min Summer	8.035	0.135	20.8	48.9	O K
5760 min Summer	8.019	0.119	16.5	43.4	O K
7200 min Summer	8.009	0.109	13.9	39.5	O K
8640 min Summer	8.001	0.101	12.0	36.6	O K
10080 min Summer	7.995	0.095	10.7	34.4	O K
15 min Winter	8.559	0.659	133.0	239.4	O K
30 min Winter	8.675	0.775	133.0	281.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	115.731	0.0	276.5	15
30 min Summer	77.804	0.0	372.2	24
60 min Summer	49.937	0.0	478.8	42
120 min Summer	30.956	0.0	593.7	74
180 min Summer	23.058	0.0	663.4	104
240 min Summer	18.577	0.0	712.7	134
360 min Summer	13.656	0.0	785.9	190
480 min Summer	10.974	0.0	842.1	252
600 min Summer	9.254	0.0	887.6	312
720 min Summer	8.046	0.0	926.2	370
960 min Summer	6.447	0.0	989.4	492
1440 min Summer	4.709	0.0	1083.8	736
2160 min Summer	3.432	0.0	1185.7	1100
2880 min Summer	2.739	0.0	1261.4	1468
4320 min Summer	1.989	0.0	1373.5	2192
5760 min Summer	1.583	0.0	1458.4	2936
7200 min Summer	1.325	0.0	1526.0	3632
8640 min Summer	1.147	0.0	1584.8	4400
10080 min Summer	1.015	0.0	1636.3	5088
15 min Winter	115.731	0.0	309.8	15
30 min Winter	77.804	0.0	417.0	25

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Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
60 min Winter	8.695	0.795	133.0	289.1	O K
120 min Winter	8.549	0.649	133.0	236.1	O K
180 min Winter	8.395	0.495	132.0	179.9	O K
240 min Winter	8.299	0.399	127.2	145.0	O K
360 min Winter	8.229	0.329	98.2	119.5	O K
480 min Winter	8.189	0.289	80.4	104.9	O K
600 min Winter	8.161	0.261	68.3	95.0	O K
720 min Winter	8.141	0.241	59.7	87.8	O K
960 min Winter	8.113	0.213	48.1	77.5	O K
1440 min Winter	8.080	0.180	35.4	65.3	O K
2160 min Winter	8.051	0.151	25.8	55.0	O K
2880 min Winter	8.034	0.134	20.7	48.8	O K
4320 min Winter	8.013	0.113	15.0	41.2	O K
5760 min Winter	8.001	0.101	12.0	36.6	O K
7200 min Winter	7.992	0.092	10.0	33.3	O K
8640 min Winter	7.985	0.085	8.7	30.9	O K
10080 min Winter	7.980	0.080	7.7	29.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
60 min Winter	49.937	0.0	536.3	44
120 min Winter	30.956	0.0	665.0	78
180 min Winter	23.058	0.0	743.1	108
240 min Winter	18.577	0.0	798.3	134
360 min Winter	13.656	0.0	880.3	194
480 min Winter	10.974	0.0	943.2	254
600 min Winter	9.254	0.0	994.2	314
720 min Winter	8.046	0.0	1037.4	376
960 min Winter	6.447	0.0	1108.3	494
1440 min Winter	4.709	0.0	1214.0	736
2160 min Winter	3.432	0.0	1328.0	1104
2880 min Winter	2.739	0.0	1412.8	1468
4320 min Winter	1.989	0.0	1538.5	2204
5760 min Winter	1.583	0.0	1633.5	2928
7200 min Winter	1.325	0.0	1709.2	3568
8640 min Winter	1.147	0.0	1775.1	4392
10080 min Winter	1.015	0.0	1832.9	5056

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 1.280

Time (mins)		Area
From:	To:	(ha)
0	4	1.280

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 7.900

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	363.5	0.700	363.5	1.400	363.5	2.100	363.5
0.100	363.5	0.800	363.5	1.500	363.5	2.200	363.5
0.200	363.5	0.900	363.5	1.600	363.5	2.300	363.5
0.300	363.5	1.000	363.5	1.700	363.5	2.400	363.5
0.400	363.5	1.100	363.5	1.800	363.5	2.500	363.5
0.500	363.5	1.200	363.5	1.900	363.5		
0.600	363.5	1.300	363.5	2.000	363.5		

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Application	Surface
Sump Available	Yes
Diameter (mm)	450
Invert Level (m)	7.900
Minimum Outlet Pipe Diameter (mm)	500
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	133.3
Flush-Flo™	0.576	133.0
Kick-Flo®	0.749	129.0
Mean Flow over Head Range	-	91.0

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0.600	132.9	2.200	218.4	5.500	342.4	9.500	443.4
0.800	133.3	2.400	227.9	6.000	357.3		
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