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1. INTRODUCTION

Civic Engineers have been appointed by Maple Grove Development to prepare a Flood Risk Assessment for a proposed development at Coach Rd., Whitehaven.

The Report is to be submitted in support a full Planning Application for a proposed new extra care facility.

2. SITE DESCRIPTION

The site is located at Coach Road, Whitehaven with nearest postcode CA28 9DF and OS Grid Coordinates 297408, 517416.

The site is bounded by Coach Road to the south, the culverted Pow Beck to the west and a section of the Coast 2 Coast cycle route to the east.

The total site area is approximately 1.039Ha in area with approximately 0.5Ha covered in hardstanding and buildings. The remaining section, to the east of the site, is covered in scrubland. None of the buildings at the site are currently occupied. An aerial image of the site can be seen below.

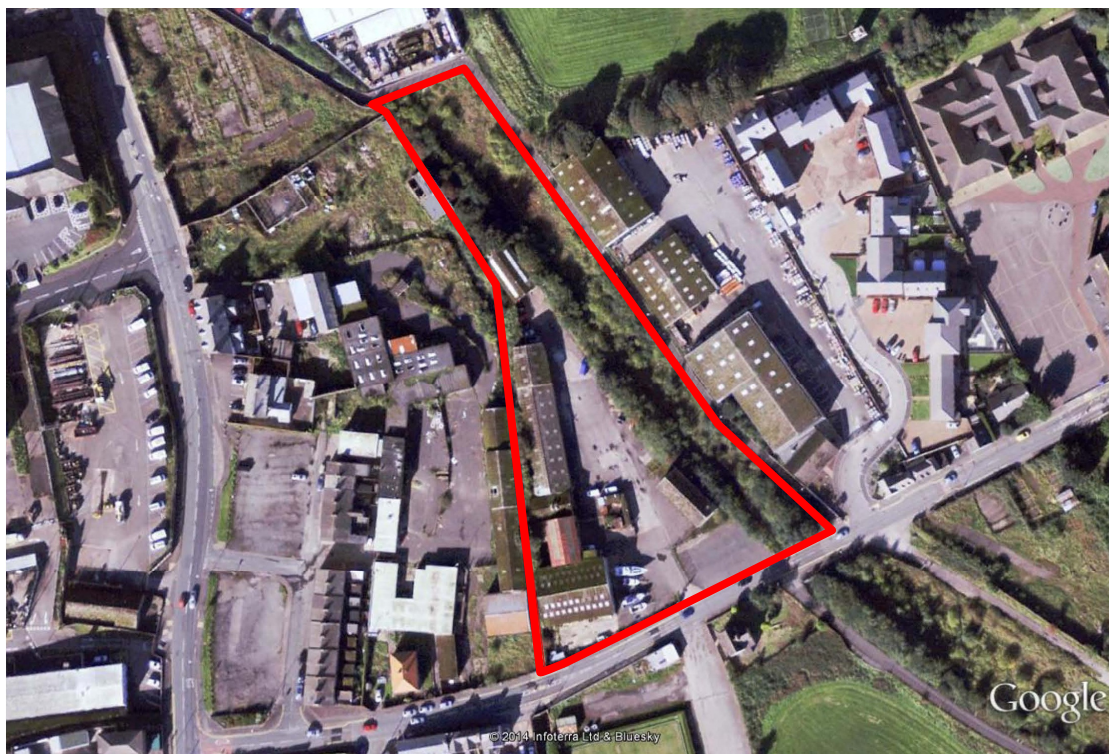


Figure 1; Aerial Image of the site taken from Google Earth (2008)

3. FLOOD RISK TO THE SITE

3.1 Flood Risk from Pow Beck

The Pow Beck runs in culvert along the western boundary of the site running from north to south. The bed level of the Beck has been recorded at approximately 5.1mAOD, (around 2-2.5m lower than the existing site level). The majority of the surface water run-off from the site discharges via a network of gullies and pipes into the culverted section of the Beck; drainage survey has shown that a small area to the south of the site discharges to the public sewer within Coach Rd.

Current Environment Agency flood maps show the Site falls within Flood Zone 2, as shown on Figure 2 below, and as such has a medium probability of flooding (between 1in100 1in1000 and annual probability of flooding) from the Pow Beck. Flood Event level information has been obtained from the Environment Agency and the information is included within Appendix B of this document.

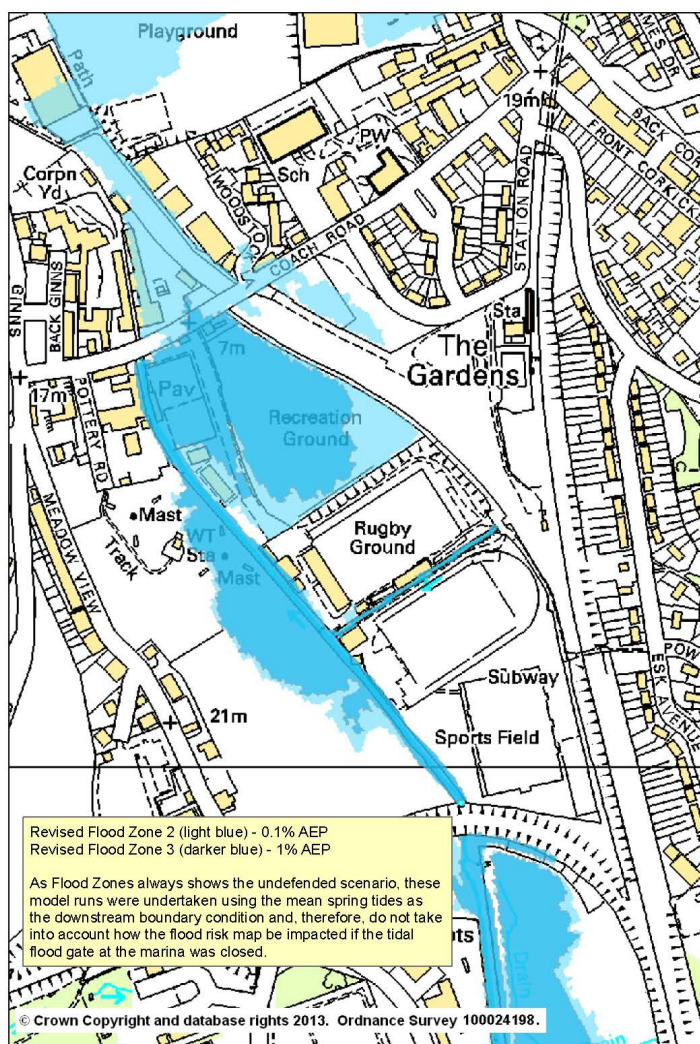


Figure 2 Environment Agency Flood Maps provided December 2013

3.2 Flood Risk from Sewers & Overland Flow

A utilities search has been undertaken and the affected utilities transposed on to Civic Engineers drawing 559-01 SI 002 in Appendix A of this document.

There have been several recorded surface water flooding events which have been accredited to surcharging of the combined sewer within Coach Rd., the most recent of such events occurred in January 2014 and previous events have been recorded in 1999, 2006 and 2007. Mapping provided by the EA showing the pattern of flooding for the historic events is contained in Appendix B of this document.

The pattern of flooding in the 2006 and 2007 is shown on Figure 2 below. The extents of the flooding ties in with the topography of Coach Rd. which has a low point to the east of the proposed development site. Footage and photographs of the flooding which occurred in 2014 shows a similar pattern and extent of flood waters to that shown on the EA maps although shallow flooding was also recorded further along Coach Rd. adjacent to the site. The extents of flooding are illustrated on Civic Engineers drawing SI 003 in Appendix A which is based on photographs provided by photographs supplied by a member of the public attending the 20/02/14 public exhibition.

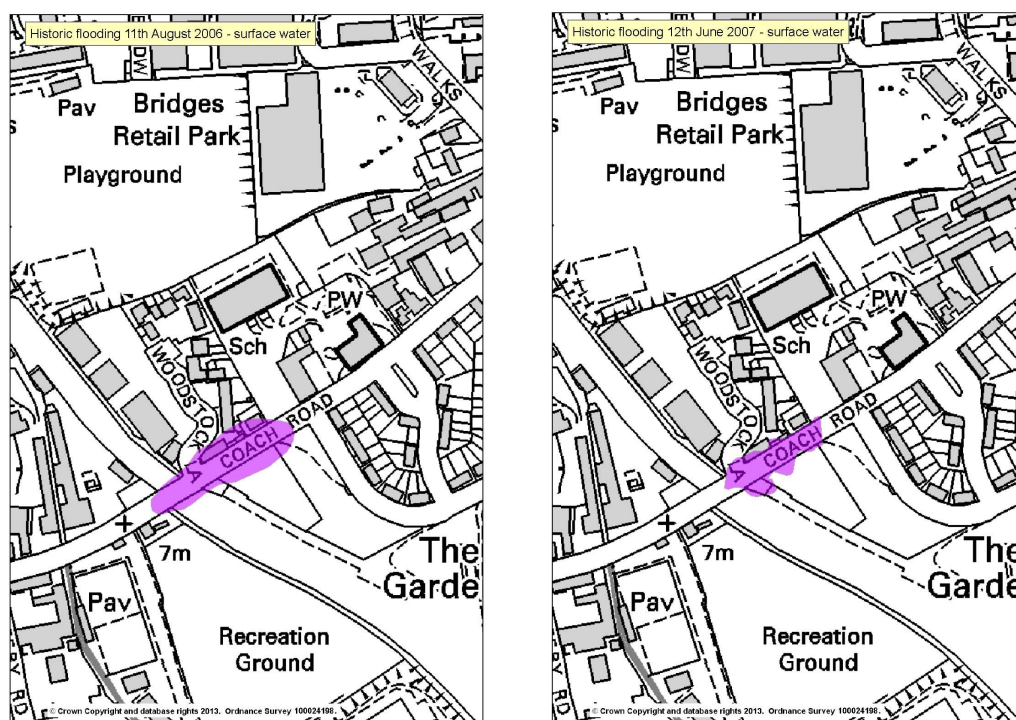


Figure 3 Environment Agency Maps showing Extents of Historic Surface Water Flooding provided August 2013.

3.3 Hydrology & Hydrogeology

Maps obtained through Envirocheck search show the site to overlie a Secondary A Aquifer relating to the underlying alluvium and coal measures.

The site does not sit within a Source Protection Zone.

4. DEVELOPMENT PROPOSALS

The brownfield site will be redeveloped to provide an extra care and dementia facility for people aged 55 and over. The facility will include a three storey apartment building providing 56 units and 4 bungalows which will have access to facilities in the main building.

The new development will sit approximately 4.5m off the wall of the culverted Pow Beck, at its closest point.

5.0 IMPACTS ON DEVELOPMENT & PROPOSED MITIGATION MEASURES

The NPPF Technical Guide classifies the flood risk vulnerability of residential institutions such as care homes as 'more vulnerable' and Table 3 of the Technical Guide indicates that such development is compatible with Flood Zone 2.

The Sequential Test has been undertaken by Garner Planning and no reasonably available sites in Flood Zone 1 were identified. Sequential Test summary document can be found in Appendix C of this document.

Whilst surface water flooding in the vicinity of the site has occurred more recently and more frequently than flooding from the Beck the surface water flooding does not pose a risk to the proposed development. The depth and extents of flooding associated with the Beck would be far more significant and as such flooding from the Beck has been the primary consideration in developing the flood risk mitigation strategy. The following mitigation measures are proposed to ensure that the proposed development is safe and does not lead to an increased risk of flooding elsewhere:

- Ground floor level will be set at the 1in100yr +climate change flood level + 600mm. (8.39mAOD)
- Safe access routes will be provided from all occupiable areas of the development to "safe haven" within Flood Zone 1 on Coach Road at the western end of the development.(minimum level 7.91mAOD).
- Smaller vehicles (to a maximum of 7.5T and including ambulances) will be able to access the development from the higher level on Coach Road if necessary in the event of an Emergency.
- The proposed new apartment block will be raised above ground level "on stilts" so as not to displace flood waters.
- The surface water run-off generated by the 1 in 100 year critical storm will be limited so that it will not exceed the run-off from the undeveloped site and will not increase the risk of flooding off-site.

If flooding were to occur to such an extent that Coach Rd. was closed to vehicular access then it is anticipated that staff or visitors to the development would park their cars in the vicinity of Coach Rd. and access the development on foot via the raised access point.

Based on 1in100yr flood levels the maximum depth of localised flooding that would occur to Coach Rd., in the vicinity of the development would be approximately 500mm. As ambulances could gain access through the secondary vehicle access from the higher level on Coach Road, the only vehicles that may need to access the site during an extreme event would be fire tenders which if necessary could manoeuvre through this depth of water.

6.0 SURFACE WATER DRAINAGE STRATEGY

Site investigation has identified that the site sits over varying depths of contaminated made ground over alluvium clays, sands and gravels. These conditions are not favourable for the use of infiltration techniques for the disposal of surface water.

It is proposed that the surface water drainage strategy will generally replicate the existing in that run off will be discharged from roofs and hardstanding to the Beck.

Due to the capacity issues associated with the combined sewer in Coach Rd. it is proposed that the existing surface water connection to this sewer will be terminated and no run off from the development will be discharged into Coach Rd., this will contribute towards reduced flood risk from this source.

Surface water flows from the site will be limited to match the pre-development discharge rates and the development will be designed to ensure that run off from a 1in 100yr storm (plus an allowance for climate change) is managed so as to remain within the site boundary and so as not to damage property.

Initial calculations have shown that up to 34m³ of surface water attenuation may be required in order to contain additional flows from a 1in30yr (+climate change) storm. Surface water run off will be controlled as near to source as possible and SuDS techniques will be employed where practicable given the anticipated ground conditions and proposed end use of the development

Calculations have shown that a 1in100yr (+climate change) storm could require an additional 11m³ of attenuation. It is proposed that this additional attenuation will be provided at surface level through controlled flooding of external areas within the site boundary.

Calculations can be found in Appendix D of this document.

In order to facilitate the proposed development it will be necessary to divert a short section of the existing public sewer within the site boundary, the details of the proposed diversion works will be subject to agreement with United Utilities.

7.0 CONSULTATION

Pre-application Consultation was issued to the Environment Agency in January 2014 and response provided in February 2014. The response advised measures which should be incorporated into the development to mitigate against the risk of flooding from the Pow Beck and these are included within the Development proposals (Correspondence can be found in Appendix B of this document).

At the public consultation on 20/02/14 useful information was provided by members of the public on the precise nature of flooding in the local area. Confirmation was given that the site does not flood but the extent of flooding on Coach Road was identified with photographic evidence and we have been able to take this information into account. Email correspondence from a local resident is included in Appendix B and photographs provided are included on Civic Engineers drawing SI 003 in Appendix A.

8.0 CULVERT SURVEY

Drainage and Culvert Survey was undertaken by OnSite Surveys in January 2014 and is available for review on request.

A copy of the survey has been provided to Joe March, Flood & Coastal Risk Management, Asset Protection, Environment Agency.

9.0 CONCLUSION

The NPPF Technical Guide classifies the flood risk vulnerability of residential institutions such as care homes as 'more vulnerable' and Table 3 of the Technical Guide indicates that such development is compatible with Flood Zone 2.

The Sequential Test has been undertaken by Garner Planning and no reasonably available sites in Flood Zone 1 were identified

All forms of flood risk to the site have been assessed and mitigation measures included within the development proposals to ensure that safe development can be achieved.

The proposed surface water management strategy will ensure that no run off from the site will flow towards Coach Rd. as such the risk of flooding to Coach Rd. and the adjacent properties will not increase as a result of the development.

Appendix A: Civic Engineers Existing Site Drawings

559-01 SI 001 Existing Site Plan

559-01 SI 002 Existing Utilities Plan

559-01 SI 003 Approximate Extents of Surface Water Flooding December 2013

559-01 SI 005 Existing Site Sections (Sheet 1of2)

559-01 SI 006 Existing Site Sections (Sheet 2of2)

Appendix B: Site Flood Maps & Levels Received from Environment Agency + Consultation Response

Appendix C Sequential Test

Appendix D Surface Water Drainage Calculations

1.0 Introduction

The purpose of the surface water Management analysis report is to establish the required attenuation volumes for restricted surface water run-off rates from the proposed development.

The proposed run-off rates are to be restricted to that of the existing.

The existing site area (excluding scrubland) is approximately 5000m² and is and is 100% impermeable in the pre-development condition.

The proposed development area will also be 5000m² and will also be considered to be 100% impermeable.

2.0 Existing Run-Off Rates

Existing Impermeable Surface Water Run-Off Rates

The figures to calculate the impermeable run-off rates are taken from the Flood Studies Report (FSR) rainfall data, to which the relevant variables for this site are:-

Existing Impermeable Area	=	0.5 ha
M5 – 60 (mm)	=	16.000
Ratio R	=	0.259
C _v (Summer)	=	0.750
C _v (Winter)	=	0.840
Time of Entry	=	5 minutes
Climate Change	=	0

Based on the above variable the surface water run-off rates for the existing impermeable area are as follows:-

Q ₂ (1 in 2 Year Storm Event)	=	77 l/s
Q ₃₀ (1 in 30 Year Storm Event)	=	146 l/s
Q ₁₀₀ (1 in 100 Year Storm Event)	=	185 l/s

3.0 Proposed Surface Water Run-Off Rates

Proposed Impermeable Surface Water Run-Off Rates

As before, the figures to calculate the impermeable run-off rates are taken from the Flood Studies Report (FSR) rainfall data, to which the relevant variables for this site are:-

Proposed Impermeable Area	=	0.5 ha
M5 – 60 (mm)	=	16.000
Ratio R	=	0.259
C _v (Summer)	=	0.750
C _v (Winter)	=	0.840
Time of Entry	=	5 minutes
Climate Change	=	30%* ¹

*¹ PPS25 Table B.2 shows that the peak rainfall intensity will increase by 30% by the years 2085 to 2115. It is anticipated that the design life of the development will fall into these years and therefore will be subjected to a rainfall (climate change) increase of 30%.

Based on the above variable the surface water run-off rates for the proposed impermeable area are as follows:-

Q ₂ (1 in 2 Year Storm Event)	=	101 l/s
Q ₃₀ (1 in 30 Year Storm Event)	=	185 l/s
Q ₁₀₀ (1 in 100 Year Storm Event)	=	244 l/s

4.0 Surface Water Attenuation Requirements

The anticipated attenuation volumes if the proposed surface water run-off rates were to be restricted to the existing impermeable run-off rates are as follows:-

Storm Event	Restricted Discharge Rate	Impermeable Area	* ¹ Attenuation Range	* ² Approximate Attenuation Required
Q ₂ + 30% CC	77 l/s	0.5 ha	0m ³ - 18m ³	9m ³
Q ₃₀ + 30% CC	146 l/s	0.5 ha	0m ³ - 34m ³	17m ³
Q ₁₀₀ + 30% CC	185 l/s	0.5 ha	0m ³ - 45m ³	23m ³

*¹Attenuation ranges shown in table are estimated volume for a storage structure. The required storage structure volume will vary depending upon the drainage network design, i.e. if a network consists of large pipes and manholes the storage structure required will be lower, and if the network consists of smaller pipes and manholes the storage structure required will be higher.

*²Approximate attenuation required is the average volume of the attenuation range. This figure is to be confirmed during the full design of the surface water drainage network.