

Butlin's Splash, Bognor Regis
Level 2 Flood Risk Assessment
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List of Acronyms

AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
CC	Climate Change
EA	Environment Agency
FRA	Flood Risk Assessment
FWMA	Flood and Water Management Act
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
SFRA	Strategic Flood Risk Assessment
SPZ	Source Protection Zone
SuDS	Sustainable Drainage System
WTS	Waste Transfer Station

1 INTRODUCTION

1.1 Commission

- 1.1.1 AECOM was commissioned by Bourne Leisure in February 2016 to prepare a site specific flood risk assessment (FRA) to support a planning application for the construction and operation of a new swimming pool at Butlin's in Bognor Regis.
- 1.1.2 This Level 2 FRA has been prepared in accordance with the National Planning Policy Framework (NPPF)¹ and its associated Planning Practice Guidance (PPG) technical notes².

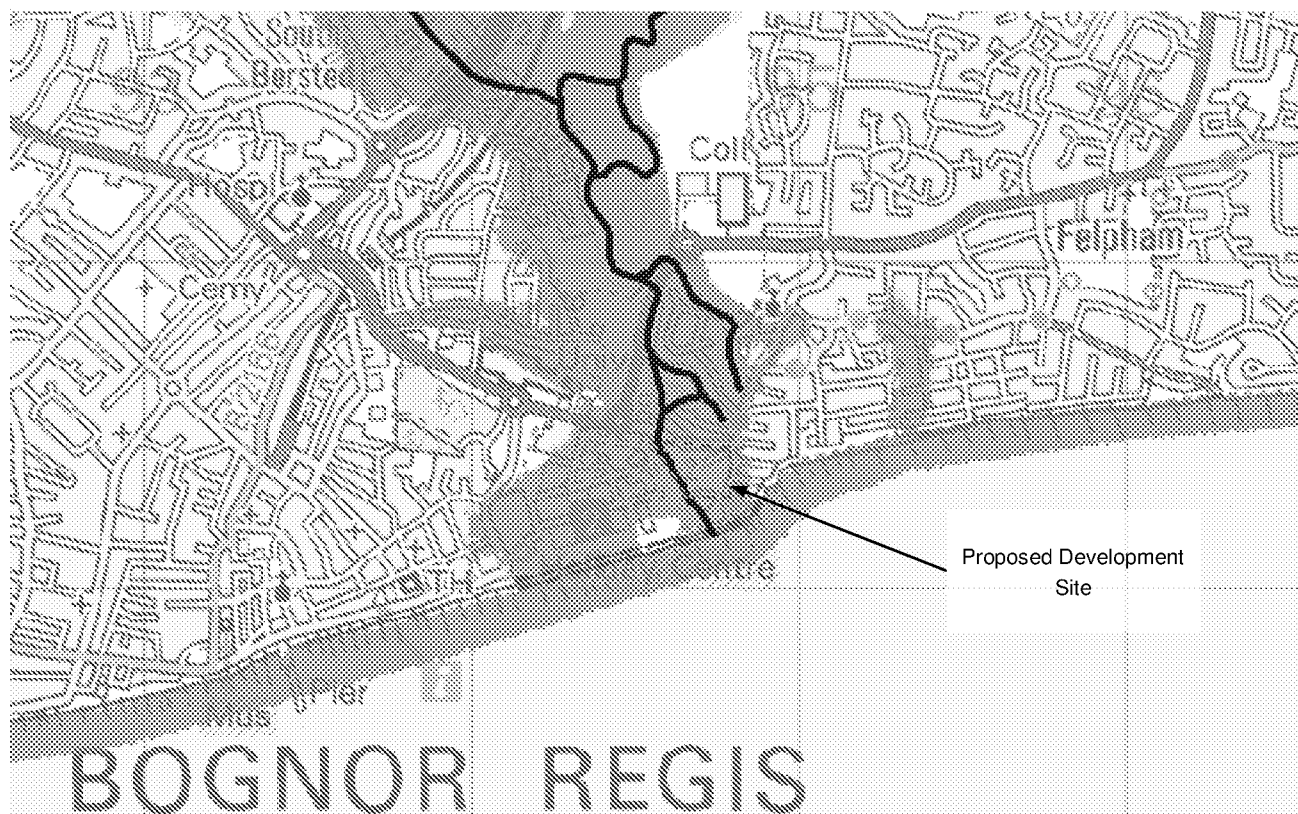
1.2 Background

- 1.2.1 Bourne Leisure has operated a holiday centre in Bognor Regis since 1960. The Butlin's Bognor Regis Resort is currently fully developed for residential, commercial and leisure use.
- 1.2.2 The area of land situated within the north eastern part of the Holiday Centre in Butlin's Bognor Regis (hereafter referred to as the "Site") is situated within Arun District Council, south east of the intersection of Upper Bognor Road and Felpham Way (A259). A topographical survey of the Site is contained within Appendix A.
- 1.2.3 The proposed redevelopment includes demolition of the existing swimming pool building and re-instatement of vacated site as landscaped area; demolition of existing staff and guest accommodation (1,005 bed spaces); erection of new swimming pool building with external slides and river ride; associated landscaping; new pedestrian links; alterations to existing car parks areas; proposed decked car park; new gatehouse for guest reception, alterations to site internal road layout; and the formation of temporary construction access.
- 1.2.4 The Site is situated directly north of the sea. The nearest watercourse to the Site is the Aldingbourne Rife, which flows along the western site boundary. Figure 1-1 details the Environment Agency Flood Map for Planning³ and the approximate boundary for the Site (3.2 ha). This figure indicates that the proposed development lies within Flood Zone 3, which comprises land assessed as having a 1 in 100 or greater annual probability of river (> 1%) or 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- 1.2.5 The NPPF¹ and the associated PPG technical notes² specify that planning applications for a development proposal of 1 hectare or greater located in Flood Zone 1 and all proposals for new development located in Flood Zones 2 and 3 should be accompanied by a FRA.
- 1.2.6 As a consequence, a FRA is required to be submitted as part of the planning application for the proposed development. A FRA must consider the vulnerability of the site to flooding from tidal, fluvial, groundwater and pluvial sources, as well as provide an assessment of the potential for the proposed development to increase flood risk elsewhere through changes in the generation and management of surface water run-off.
- 1.2.7 There are three levels of FRA: Level 1 (Screening Study); Level 2 (Scoping Study) and Level 3 (Detailed Study). A Level 2 FRA makes an assessment of flood risk to and from the proposed site that is suitable for submission with a planning application. Level 2 FRAs are based on data that is already available, but where this is not sufficient a Level 3 FRA may be recommended. This Level 2 FRA is sufficient to support the planning application for development at the Site.

¹Communities and Local Government (2012) 'National Planning Policy Framework', Department for Communities and Local Government: London.

²Communities and Local Government (2015) 'Planning Practice Guidance Note 7: Flood Risk and Coastal Change' Department for Communities and Local Government: London.

³ Environment Agency, 'Flood Map for Planning (Rivers and Sea)', available online at <http://maps.environment-agency.gov.uk/>, accessed 29th August 2016.

Figure 1-1: Site Location and Environment Agency Flood Map for Planning³

1.3 Flood Risk Assessment Methodology

- 1.3.1 The aim of a FRA is to assess the risk of all forms of flooding to and from the proposed development. In order to determine likely sources of flood risk, this FRA has used the Source-Pathway-Receptor model.
- 1.3.2 The Source-Pathway-Receptor model firstly identifies the causes or 'sources' of flooding to and from a development. The identification is based on a review of available information, local conditions and consideration of the effects of climate change. The nature and likely extent of flooding arising from any one source is considered, e.g. whether such flooding is likely to be localised or widespread.
- 1.3.3 The presence of a flood source does not always imply a risk. It is the exposure pathway or the 'flooding mechanism' that determines the risk to the receptor and the effective consequence of exposure. For example, sewer flooding does not necessarily increase the risk of flooding unless the sewer is local to the site and ground levels encourage surcharged water to accumulate.
- 1.3.4 The varying effect of flooding on the 'receptors' depends largely on the sensitivity of the target. When considering the management of local flood risk, the Flood and Water Management Act 2010 (FWMA)⁴ requires Lead Local Flood Authorities (LLFAs) to consider people, the economy and the environment. Receptors may therefore include people and their properties, businesses and infrastructure, and the built and natural environment within the range of the flood receptors, which are connected to the sources of flooding by a pathway.
- 1.3.5 In order for there to be a flood risk, all elements of the model (a flood source, a pathway and a receptor) must be present. Furthermore, effective mitigation can be provided by removing one element of the model, for example by removing the pathway or receptor.

⁴ Flood and Water Management Act (2010) available at <http://www.legislation.gov.uk/ukpga/2010/29/contents>.

1.4 Determining the Level of Risk

- 1.4.1 Using the outputs of the Source-Pathway-Receptor model, a risk based approach has been adopted for all flood sources that have a pathway to the receptor within this FRA. The level of risk is then defined as:



- 1.4.2 The approach to this FRA involves a predominantly desk-based review of available information to establish the likely flooding sources and mechanisms for the site. Once the flood risk has been established, mitigation measures are recommended where necessary and further work identified.
- 1.4.3 The scope of this commission excludes hydraulic and hydrological modelling and is therefore principally a qualitative assessment based on published data.

1.5 Aims and Objectives

- 1.5.1 The aim of this report is to assess the flood risk associated with the proposed development. As stated in paragraph 102 of the NPPF PPG², a site-specific FRA should:

"...demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall."

- 1.5.2 In order to achieve this, the following objectives have been met:

- Consult with the Environment Agency to confirm the flood zone, historic flooding, flood defences and if available modelled flood levels within the vicinity of the Site;
- Carry out desk based research exercise to collate information that influence flood risk and flood risk management to and from the site, including geology, soils, topography and planning policy documentation which will be summarised in the FRA report;
- Utilise available information to carry out a desk-based qualitative assessment of the risk of flooding both arising from development and posed to development from all sources of flooding including fluvial, surface water run-off (sheet run-off from adjacent land), groundwater, and flooding from the local drainage network;
- Where necessary, recommend suitable flood mitigation measures in line with the recommendations of current best practice documents, suitable for the intended use and position of the development;
- Undertake surface water calculations and detail the proposed surface water drainage system; and,
- Prepare a report that summarises the information obtained from the above tasks and outlines flood risk at the Site.

2 PROPOSED DEVELOPMENT AND SITE CONTEXT

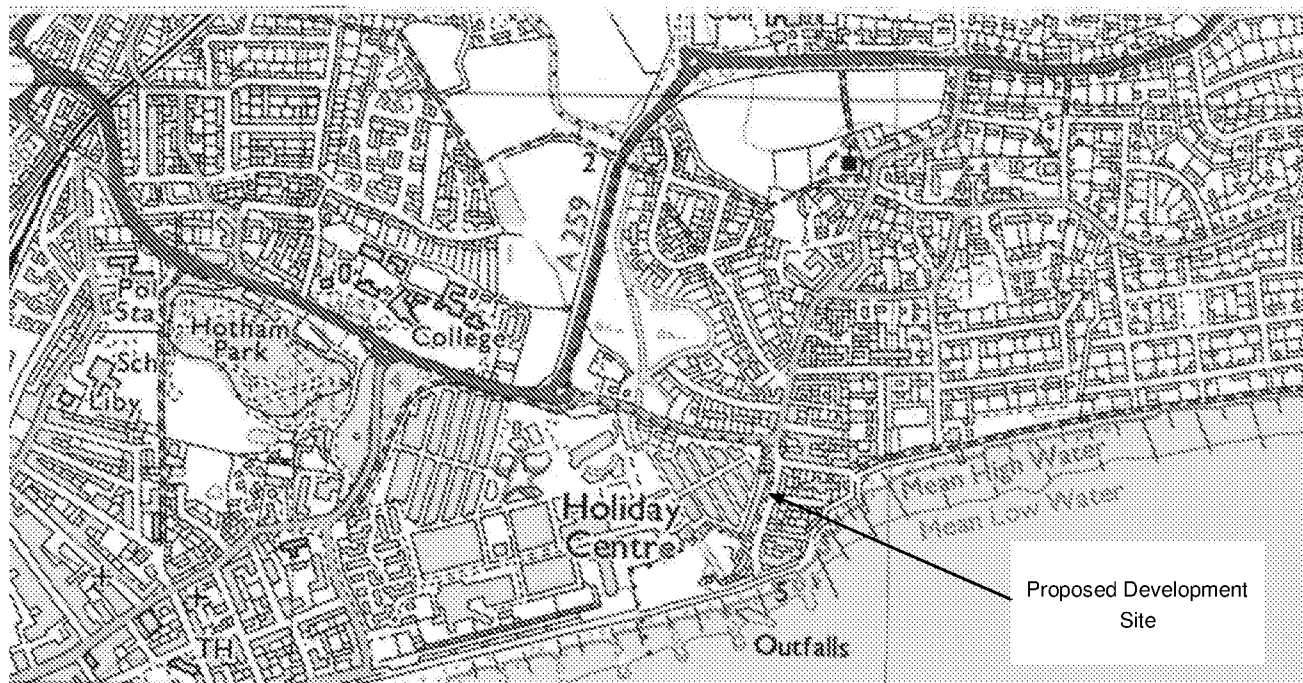
2.1 Overview

- 2.1.1 This section of the FRA describes the development proposals and the physical site characteristics to set the context of how flood sources could impact the site and how the proposals could influence flood risk elsewhere.

2.2 Location

- 2.2.1 The Site is located to the south of Upper Bognor Road and west of Sea Road in Bognor Regis. The Site is centred on grid reference X494729, Y099360, the nearest postcode is PO22 7AP and it covers an area of approximately 3.1 hectares. The Site location is shown in Figure 2-1. The land situated to the north and east of the Site is occupied by residential dwellings, whilst the remainder of the Butlin's Resort is situated to the west on the opposite side of the Aldingbourne Rife. The sea is situated to the south of the site beyond flood defences and existing buildings.

Figure 2-1: Site location (Contains Ordnance Survey data © Crown copyright and database right 2016)



2.3 Site Appearance and Access

- 2.3.1 The Site is currently developed land comprising existing staff and guest accommodation, a swimming pool, buildings, parking areas and landscaping. Access roads within the site are generally surfaced using tarmac, although small areas of footway are formed using unmade ground or gravel.
- 2.3.2 Access to the Site is from a roundabout that forms the junction between Upper Bognor Road and Felpham Way, via private roads that extend through the main Butlin's resort, which is situated to the west. The private road provides access to other buildings within the resort via a structure that spans over the Aldingbourne Rife and it provides a good connection to the strategic road network.

2.4 Proposed Development

2.4.1 The proposed development plan is presented in Appendix B. The proposed development will involve the following works:-

- demolition of existing swimming pool building and re-instatement of vacated site as landscaped area;
- demolition of existing staff and guest accommodation (1,005 bed spaces);
- erection of new swimming pool building with external slides and river ride;
- associated landscaping;
- new pedestrian links;
- alterations to existing car parks areas;
- proposed decked car park;
- new gatehouse for guest reception, alterations to site internal road layout; and the formation of temporary construction access”.

2.4.2 The drainage proposed for the developed area of the Site includes new foul drainage from the new swimming pool to the existing Southern Water sewers. Surface water will drain from the developed area to the Aldingbourne Rife in order to maintain the existing drainage regime.

2.5 Development Occupancy

2.5.1 The Site that is proposed to be redeveloped to accommodate the Butlins Splash swimming pool is currently occupied by a significant quantum of existing staff and guest accommodation, a total of 1005 bed spaces. In the event that planning consent is granted and the swimming pool is constructed, then the occupancy rate within the Butlins Bognor Regis resort is likely to be temporarily reduced, by 1005 bed spaces.

2.5.2 The Flood Risk Assessment that was prepared in November 2010 to support an application for a new hotel on the Bognor Regis resort contains correspondence from the Environment Agency within Appendix C, which indicates that development on the Bognor Regis site is based on the principle that there would be no overall increase in occupancies (i.e. the status quo with respect to the number of beds is maintained) in order to mitigate the residual risk of tidal flooding.

2.5.3 Based on this previous assessment, Bourne Leisure reserve the right to submit future applications to seek consent to reinstate the quantum of accommodation that is present on the Site prior to the construction of the swimming pool, by the 1005 bed spaces removed. These applications will ensure that habitable accommodation is positioned above the 1 in 200 year tide surge level in order to mitigate the residual risk of tidal flooding. This overall approach will enable the Bognor Regis site to be redeveloped in a sustainable manner, by ensuring that the risk of flooding to habitable accommodation is reduced.

2.6 Topography

2.6.1 An existing site plan and drainage layout including topographic information produced by The Meon Survey Partnership is included in Appendix B. A review of the existing plan indicates that ground levels across the Site fall from around 3.05 metres above ordnance datum (mAOD) at the north-eastern corner of the Site to around 2.2m in the southwestern corner.

2.6.2 Beyond the Site, the ground appears to fall generally to the south and the west toward the Aldingbourne Rife and the sea. There is an existing retaining wall along the north edge of the site, which allows the Site to be raised above Upper Bognor Road.

2.7 Geology / Hydrogeology

- 2.7.1 With reference to the British Geological Survey geological mapping⁵ for the area, the Site is underlain by superficial Raised Marine Deposits (clay, silt, sand and gravel) underlain by the Lambeth Group (clay, silt and sand). The Lambeth Group is underlain by an undifferentiated chalk formation comprising the Lewes Nodular, Seaford, Newhaven, Culver and Portsdown Formations of the Cretaceous Age.
- 2.7.2 A geotechnical investigation of the Site was undertaken by CJ Associates in April 2016, which showed that the conditions of the Site generally comprise:-
- Topsoil typically between 0.2m and 0.3m thick;
 - Made ground comprising sandy gravelly clay with brick typically between 0.7m and 1.8m thick to a depth of between 0.9m and 2.0m;
 - Raised marine deposits comprising soft clay, silty sand and silty clayey gravel with cobbles of flint typically between 15.4 and 22.6m thick to a depth of between 17.0m and 24.6m;
 - Sandy gravelly clay forming the Lambeth Group between 1.5m and 6m thick to a depth of between 18.5m and 20m;
 - Upper Chalk.
- 2.7.3 The Environment Agency Groundwater Aquifer Designation Map⁶ shows that Secondary 'A' aquifer superficial deposits extend below the Site.
- 2.7.4 Groundwater used for drinking water is protected by the Environment Agency. The Environment Agency classifies zones known as Source Protection Zones (SPZ) around potable groundwater abstraction points, designed to limit potentially polluting activities. The Environment Agency website⁷ shows that the Site is situated approximately 14 km from the nearest SPZ, located close to Rustington.
- 2.7.5 The geotechnical investigation indicates that groundwater flows were observed at depths varying between 3.4m and 18.3m. Flows were observed to occur as medium seepages within the Raised Marine Deposits at shallow depth or within the chalk at depth. Subsequent monitoring of groundwater in standpipes indicated groundwater levels at depths ranging between 2.04m and 2.77m.
- 2.7.6 Soakaway tests were undertaken during the ground investigation, which indicated that the underlying strata are unsuitable for infiltration due to the presence of impermeable strata and groundwater.

2.8 Flood History

- 2.8.1 The Arun District Council Level 1 Strategic Flood Risk Assessment⁸ states:

"The Arun District has a long history of flood events, with multiple sources of flooding. In particular, three notable flood events have affected the district in the last 60 years and these have been associated primarily with heavy rainfall, high groundwater levels, high river flows and high tides (but not necessarily in combination). The most recent events of 1974, 2000 and 2012 caused widespread flooding in the district after significantly high rainfall over an extensive period.

The West Sussex County Council June 2012 Flood Event report has identified that on the 10th, 11th and 12th June 2012, an extreme rainfall event led to widespread flooding across parts of West Sussex. Approximately 780 properties were affected by flooding from a variety of sources. The worst affected areas in the Arun District were Bognor Regis and Littlehampton. In the area of Bognor Regis, which includes Middleton on Sea, Elmer and Felpham, up to 370 properties were reported to have flooded. West Sussex County Council (WSCC) recorded that rainfall in June 2012 was 430% higher than the average rainfall for June in the Bognor Regis to Chichester area. The probability of the rainfall event for this incident was estimated to be 1 in 200 (0.5% AEP)."

The Aldingbourne Rife is also predominately rural, with the exception of the main urban area of Bognor Regis, in which it flows through to the sea. It is known to flood frequently, and when it does, the river is very slow to drain due to the low topography of the area³¹. The main flood events to have directly impacted the Aldingbourne catchment are November 1960, December 1993 and June 2012³². Across these events surface water issues are reported to be main drivers behind the flooding experiences, although these often corresponded with elevated river

⁵ British Geological Survey mapping available at <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>, accessed 29th August 2016.

⁶ Environment Agency, 'Aquifer Maps' available online at www.environment-agency.gov.uk, accessed 29th August 2016.

⁷ Environment Agency, 'Source Protection Zones' available online at www.environment-agency.gov.uk, accessed 29th August 2016.

⁸ Arun District Council Level Strategic Flood Risk Assessment by JBA Consulting (August 2016)

levels which influence drainage of surface water. In the case of the 1993 event inadequate culvert capacity at Barnham also contributed to flooding experienced. The Aldingbourne catchment was particularly affected during the 2012 flood event, with over 400 properties being affected in areas of Bognor Regis, Barnham, Elmer, Middleton and Felpham. The flood mechanism was thought to be primarily surface water but this was exacerbated by fluvial flooding from the Rife network. There were also some isolated areas impacted by flooding such as Shripney, Westergate and Yapton"

- 2.8.2 Historic flood extent mapping⁹ contained within the Strategic Flood Risk Assessment as detailed in Appendix C indicates that the Site was not flooded during any of the historic events that are outlined above.

2.9 Current Flood Risk Management

Flood Defences

- 2.9.1 Plans contained within the Strategic Flood Risk Assessment⁹ duplicated in Appendix C show the areas benefiting from defences.
- 2.9.2 These plans highlight the presence of an embankment and a wall that, provided they are maintained by the Environment Agency, provide protection against tidal flooding with a return period of up to 1 in 200 years.
- 2.9.3 There is also an embankment adjacent to Upper Bognor Road in Bognor Regis which extends across the Aldingbourne Rife (NGR: 494669, 099456). The maintenance of this embankment is unknown along with the standard of protection and condition grading.

Flood Warning / Alert Area

- 2.9.4 The Environment Agency monitor rainfall, river levels, sea levels and groundwater levels and, in collaboration with the Meteorological Office, provide local forecasts on the likelihood of flooding. Using this information, the Environment Agency issue three kinds of flood warning: 'flood alert', 'flood warning' and 'severe flood warning'.
- 2.9.5 The Environment Agency website¹⁰ indicates that the Site is within a coastal flood warning zone and a river flood warning zone for the Aldingbourne Rife. Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

⁹ Historic Flood Maps contained within Arun District Council Level Strategic Flood Risk Assessment by JBA Consulting (August 2016)

¹⁰ Environment Agency, 'Flood Warning Area Maps' available online at www.environment-agency.gov.uk, accessed 29th August 2016.

3 FLOOD SOURCES

3.1 Overview

- 3.1.1 This section of the FRA describes the first stage of the Source-Pathway-Receptor model and identifies all potential flood sources to the Site. The second and third stages of the Source-Pathway-Receptor model are described in Section 5.



- 3.1.2 The NPPF¹ requires that all potential sources of flooding that could affect the proposed development are considered within a FRA. This includes flooding from rivers and the sea, directly from rainfall on the ground surface, rising groundwater, surcharged sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

3.2 Tidal Sources

- 3.2.1 Tidal sources of flooding include seas and estuaries. Flooding from these sources can occur through overtopping of defences, breaching of defences and wave action.
- 3.2.2 The Environment Agency Flood Map indicates that the Site is in a high probability flood zone (Flood Zone 3) for flooding from sea, although this does not take into account the tidal flood defences along the site boundary with the English Channel.
- 3.2.3 Based on the above information, tidal sources have been identified as a potential residual flood risk and are considered further in Section 5.

3.3 Fluvial Sources

- 3.3.1 Flooding from fluvial sources can occur through: inundation of floodplains from watercourses; inundation of areas outside the floodplain due to the influence of bridges, embankments and other features that artificially raise water levels; overtopping of defences; breaching of defences; blockages of culverts; and blockages of flood channels or flood corridors.
- 3.3.2 The closest watercourse to the Site is the Aldingbourne Rife, which flows along the western boundary of the Site. The Environment Agency Flood Map for Planning and correspondence provided within Appendix C indicates that the Site is situated within Flood Zone 1. However, there is a risk that fluvial sources are a potential flood risk if ground levels are reduced and the risk of fluvial flooding is considered further within Section 5.

3.4 Artificial Sources

- 3.4.1 Artificial flood sources include raised channels such as canals or storage features such as ponds and reservoirs.
- 3.4.2 With reference to the Environment Agency Flood Risk from Reservoirs Map¹¹, no artificial sources of flooding have been identified; therefore it is considered that artificial sources do not present a flood risk to the Site.

¹¹Environment Agency, 'Flood Map Risk of Flooding from Reservoirs', available online at www.environment-agency.gov.uk, accessed 29th August 2016.

3.5 Overland Flow (Pluvial) Sources

- 3.5.1 Surface water flooding results from the accumulation of rainfall that does not infiltrate into the ground or flow into drainage systems. This run-off flows across the ground surface and ponds in low-lying areas. This is exacerbated by impermeable urban development, low permeability soils and geology (such as clayey soils) and drainage systems with inadequate capacity. Large areas of impermeable tarmac and paving within urban expanses can cause large volumes of water to flow over the surface and enter drainage systems more quickly, possibly causing flooding due to exceeded drainage capacity.
- 3.5.2 The proposed development will mostly comprise hardstanding areas; therefore run-off on the Site is a potential issue. In addition, the land on the northern side of the Site falls towards the northern and eastern boundary and there is therefore potential for surface run-off from external areas to impact the proposed development.
- 3.5.3 Considering the above, flooding as a result of overland flow (surface water) has been identified as a potential flood risk and is considered further in Section 5.

3.6 Groundwater Sources

- 3.6.1 Groundwater flooding occurs where groundwater levels rise above the level of the ground surface. Geology is a major influence on where this type of flooding takes place; it is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).
- 3.6.2 The Environment Agency Groundwater Aquifer Designation Map⁶ indicates the site is located on a Secondary A aquifer for superficial deposits defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally the aquifers formerly classified as minor aquifers.
- 3.6.3 According to the British Geological Survey mapping, the underlying stratum is the Lambeth Group, made up of clay, silt and sand. The Ground Investigation Report by CJ Associates indicates that groundwater depths range between 2.04m and 2.77m. This investigation indicates the presence of an artesian type aquifer (a confined aquifer containing groundwater that will flow upward through a well) around 15m below ground level in both the underlying alluvial sand and chalk. If encountered the water is likely to rise to within a meter of ground level. Additionally, new developments that penetrate the groundwater table have the potential to displace groundwater and increase groundwater flood risk to the surrounding areas.
- 3.6.4 Based on the above information, groundwater has been identified as a potential flood risk and is considered further in Section 5.

3.7 Sewer Sources

- 3.7.1 Sewer flooding occurs when the sewer capacity becomes exceeded, or where a blockage occurs causing the sewer to surcharge and flood.
- 3.7.2 Southern Water asset location plans, which are contained within Appendix D, highlight the presence of foul sewers situated below the roads that extend around the northern, eastern and southern perimeter of the Site and several foul pumping stations. The asset location plans also indicate the surface water sewers extend below roads situated to the eastern and southern Site boundary. The Arun District Council SFRA has mentioned some recorded historic incidents of sewer flooding in the vicinity of the Site. However, Southern Water has installed flood mitigation storage at Upper Bognor Road in 2007 to reduce wastewater flooding (Appendix D).
- 3.7.3 An existing drainage plan is presented in Appendix A, which indicates that the existing surface water drainage system within the Site comprises a network of carrier drains that collect surface water from existing buildings and external paved areas before conveying the flow in a westerly direction across the Site and discharging to the Aldingbourne Rife via a 225mm outfall. No attenuation storage or petrol interceptors have been identified within the Site. The design standard of these sewers is not known, therefore they could surcharge and possibly flood after high intensity rainfall.
- 3.7.4 Considering the above, flooding as a result of sewers (surface water) has been identified as a potential flood risk and is considered further in Section 5.

3.8 Summary of Flood Sources

3.8.1 Table 3-1 summarises the potential flood sources that have been identified and whether they are considered further in this FRA.

Table 3-1: Summary of Potential Flood Sources

Flood Mechanism	Source	Considered Further?
Tidal	English Channel	Yes
Fluvial	Aldingbourne Rife	Yes
Artificial	No artificial sources have been identified	No
Pluvial (Overland Flow)	Site and surrounding hard standing areas	Yes
Groundwater	An aquifer has been identified beneath the Site	Yes
Sewer	Southern Water sewers and private surface water sewer network	Yes

4 PLANNING POLICY AND GUIDANCE DOCUMENTS

4.1 Overview

4.1.1 The planning policies and recommendations relevant to the proposed development are listed in this section, along with how this FRA addresses each policy and where this has been reported.

4.2 National Policy – National Planning Policy Framework ¹

4.2.1 Section 10 of the NPPF¹ and the associated PPG² notes provide the current national policy and guidance for planning with respect to flood risk, as well as sustainable drainage systems (HCWS161).

4.2.2 The NPPF¹ advocates a sequential approach for the planning process, in order to steer development to areas with the lowest possible risk of flooding.

4.2.3 The NPPF¹ considers the vulnerability of different forms of development to flooding and classifies proposed uses accordingly as detailed in Table 2 of the PPG, which is reproduced in Table 4-1. The vulnerability classification of the proposed development is boxed in red within this table.

Table 4-1: PPG² (Table 2) Flood Risk Vulnerability Classification

Vulnerability Classification	Development Uses
Essential Infrastructure	- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. - Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. - Wind turbines.
Highly Vulnerable	- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. - Emergency dispersal points. - Basement dwellings. - Caravans, mobile homes and park homes intended for permanent residential use. - Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').
More Vulnerable	- Hospitals - Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. - Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. - Non-residential uses for health services, nurseries and educational establishments. - Landfill* and sites used for waste management facilities for hazardous waste. - Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	- Police, ambulance and fire stations which are not required to be operational during flooding. - Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'More Vulnerable' class; and assembly and leisure. - Land and buildings used for agriculture and forestry. - Waste treatment (except landfill* and hazardous waste facilities). - Minerals working and processing (except for sand and gravel working). - Water treatment works which do not need to remain operational during times of flood. - Sewage treatment works, if adequate measures to control pollution and manage

Vulnerability Classification	Development Uses
	sewage during flooding events are in place.
Water-Compatible Development	- Flood control infrastructure. - Water transmission infrastructure and pumping stations. - Sewage transmission infrastructure and pumping stations. - Sand and gravel working. - Docks, marinas and wharves. - Navigation facilities. - Ministry of Defence defence installations. - Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. - Water-based recreation (excluding sleeping accommodation). - Lifeguard and coastguard stations. - Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. - Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

4.2.4 Table 3 of the PPG notes illustrates a matrix detailing which vulnerability classifications are appropriate for development within each Flood Zone. This is reproduced in Table 4-2.

Table 4-2: NPPF¹ (Table 3) Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification (Table 2 NPPF)	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
FLOOD ZONE	1				
	2		Exception Test required		
	3a	Exception Test required	⓪	Exception Test required	
	3b*	Exception Test required	⓪	⓪	*
⓪ – Development is appropriate ⓪ – Development should not be permitted *In Flood Zone 3b (functional floodplain) essential infrastructure that cannot be alternatively located and has passed the Exception Test, and water-compatible uses, should be designed and constructed to: - remain operational and safe for users in times of flood; - result in no net loss of floodplain storage; - not impede water flows and not increase flood risk elsewhere.					

4.2.5 The proposed development comprises leisure which falls into the "Less Vulnerable" category.

4.2.6 In accordance with the flood risk vulnerability table (Table 4-2), a development classified as 'Less Vulnerable' is permitted within all flood zones without need for the Exception Tests to be undertaken.

4.3 Regional – Arun District Council Strategic Flood Risk Assessment

4.3.1 Arun District Council (ADC) completed a Strategic Flood Risk Assessment of the Council's area in 2016. The SFRA is primarily a planning tool. It is a pragmatic, risk-based assessment of flood risk to inform the spatial planning process.

4.3.2 According to the EA flood map and the SFRA, the site is located in Flood Zone 3. A full flood risk assessment is required for the proposed development. The existing surface water drainage system relies on pumping and is unlikely to have spare capacity. Therefore the SFRA has recommended that the surface water runoff be restricted at existing rates by means of source control measures.

- 4.3.3 The SFRA provides the region with guidance covering flood risk issues to aid future development within Arun District Council. The SFRA ^{Error! Bookmark not defined.} states:

"Arun District has a history of documented flood events and flood records indicate that the main source of risk is from surface water and groundwater sources. However, fluvial and tidal/coastal flood risk is still present, including tidal surge events propagating upstream along watercourses and wave overtopping at the coastal frontage. Additionally, fluvial/coastal interactions can influence surface water flood risk e.g. by inhibiting free discharge of surface water drainage.

The primary source of fluvial flood risk to the district is the River Arun and Aldingbourne Rife, which are of fluvial influence in the east and west of the district, respectively. Flood risk in watercourses discharge to the sea is influenced by tide levels in the lower reaches adjacent to the coast."

The Arun District is bounded by the English Channel. As such the coastline is at risk of tidal flooding. In addition, the lower River Arun has also been classified as a tidal river and water levels in the lower reaches are affected by tide levels. There is little difference in Flood Zone 2, 3a and 3b for the Arun District coastline due to the steep rise of land along the coastline, including areas of raised shingle beaches. Defence asset information provided by both the Environment Agency and Arun District Council indicates that much of this coastal frontage is deemed to not have formal flood defences, primarily at the location of the shingle beaches at Littlehampton and Bognor Regis. Whilst these areas are not classified as formal flood defences, this does not mean that they do not provide benefit in terms of flood risk by their presence. The probability of a failure of the sea defences occurring is reduced by the actions of the defence owners in maintaining the defences and beach, but there remains a residual risk from tidal flooding if the defences do fail or are overtopped.

Historic records indicate that Arun District has experienced numerous surface water / drainage related flood events, which have been attributed to a range of sources. Indeed, SWMPs have been prepared to investigate these. The primary source of surface water flooding is attributed to heavy rainfall overloading highway carriageways and paved areas, drains and gullies, as well as blockages and high water levels impeding free discharge from surface water drains and gullies. The updated Flood Map for Surface Water (uFMfSW) shows a number of surface water flow paths which predominantly follow topographical flow paths along existing watercourses with some isolated ponding located in low lying areas.

Significant groundwater flood events have been recorded across the district. This risk is supported by the Areas Susceptible to Groundwater Flooding (ASStGWF) mapping suggests that susceptibility to groundwater flooding is generally high through the district.

The Sewer Incident Report Form data supplied by Southern Water indicates a total of 315 recorded flood incidents in the district. Several post code areas have recorded incidents, with the two indicating the greatest number of entries being PO22 7 (36) and PO21 3 (30).

In relation to artificial sources of flooding, there are no records of flooding from reservoirs impacting properties inside the district."

4.4 Local Policy – Core Strategy

- 4.4.1 The Arun District Local Plan 2003 was adopted on the 17th April, 2003 and covers the period up to 2011. It forms a statement of Arun District Council's planning policies, which will be used as a basis for decision making in planning applications.
- 4.4.2 The Plan has been prepared within the Planning Policy context provided at the national, regional and county level in order to meet the Council's statutory responsibilities as a Local Planning Authority. The following are the key policies that relate to the proposed development:

Policy W DM2 Flood risk

Development in areas at risk from flooding, identified on the latest Environment Agency flood risk maps and the Council's Strategic Flood Risk Assessment (SFRA), will only be permitted where all of the following criteria have been satisfied:

- a. The sequential test in accordance with the National Planning Policy Framework Technical Guidance has been met.*
- b. A site specific Flood Risk Assessment demonstrates that the development will be safe, including access and egress, without increasing flood risk elsewhere and reduce flood risk overall.*
- c. The scheme identifies adaptation and mitigation measures.*
- d. Appropriate flood warning and evacuation plans are in place; and*

e. New site drainage systems are designed to take account of events which exceed the normal design standard i.e. consideration of flood flow routing and utilising temporary storage areas.

The reports prepared as part of the criteria above must take into account contingency allowances, taking climate change into account as set out in the NPPF Technical Guidance.

In locations where strategic flood defence or resilient and resistant construction measures are necessary within the site itself, proposals will be required to demonstrate how measures have been incorporated as an intrinsic part of the scheme in a manner which is compatible with the Strategic Flood Risk Assessment.

All development proposals must take account of relevant Surface Water Management Plans, Catchment Flood Management Plans and related Flood Defence Plans and strategies such as the Lower Tidal River Arun Strategy. The council may require financial contributions from development on sites where measures to address flood risk or to improve the environmental quality of watercourses have been identified by these Plans and Strategies. Developments shall also be consistent with all other Local Plan policies.

Policy W DM3 Sustainable Urban Drainage Systems

To increase the levels of water capture and storage and improve water quality, all development must identify opportunities to incorporate a range of Sustainable Urban Drainage Systems (SUDS), appropriate to the size of development, at an early stage of the design process.

Proposals for both major and minor development proposals must incorporate SUDS within the private areas of the development in order to provide source control features to the overall SUDS design. These features include:

- Green roofs*
- Permeable driveways and parking*
- Soakaways*
- Water harvesting and storage features including water butts.*

Proposals for major development must also integrate SUDS within public open spaces and roads, in liaison with West Sussex County Council, (the SUDS Approval Body) or its agent. SUDS must therefore be integrated into the overall design of a development and must:

- a. Contribute positively to the appearance of the area*
- b. Effectively manage water (including its quality)*
- c. Accommodate and enhance biodiversity by making connections to existing Green Infrastructure assets and*
- d. Provide amenity for local residents (ensuring a safe environment) and*
- e. Retain existing open drainage ditches in their current form.*

In order to ensure that SUDS discharge water from the development at the same or lesser rate, as prior to construction, developers must:

- f. Follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations and the SUDS manual produced by CIRIA.*
- g. Undertake up to six months groundwater monitoring within the winter period.*
- h. Undertake winter percolation testing in accordance with BRE365.*
- i. The proposed drainage system must be designed to ensure that there is no flooding on a 1 in 30 year storm event.*
- j. The design must also take account of the 1 in 100 year storm event plus 30% allowance for climate change, on stored volumes, to ensure that there is no flooding of properties or the public highway or inundation of the foul sewerage system. Any excess flows must be contained within the site boundary, and within designated storage areas.*
- k. Flow routes through the development must be demonstrated as a first stage in the design process, demonstrating how water will travel at or near the surface for three types of flow:*

Low flow routes: Once surface water run-off has been collected, cleaned and controlled in source control features it will either be stored where it fell as rain in permeable pavement, or flow onward to local storage structures. The day-to-day flows from these features should travel in low flow channels through the development in a controlled way contributing to landscape quality.

Overflows: In the event of local blockages or surcharge a simple overflow arrangement should allow water to bypass the obstruction and return to the management train sequence until conditions return to normal.

Exceedance routes: When SUDS are overwhelmed by exceptional rainfall then exceedance routes protect people and property by providing unobstructed overland flow routes from the development and should be considered for all drainage schemes. The SUDS design must demonstrate that flow routes have been considered at each design stage to take into account the effect of proposed development on the natural flow pattern for the site. Exceedance routes should also be protected from future changes in land use.

Developments shall also be consistent with all other Local Plan policies.

Policy TOU DM1 Tourism related development

a. Visitor attractions, facilities and accommodation scale, priority location and Change of Use

All proposals for development, including expansion, which are likely to attract visitors (such as leisure or cultural facilities) will demonstrate that they are in accessible locations and will be accompanied by workable and realistic travel plans, address visitor management issues and achieve good design. Larger scale proposals will generally be directed towards the Economic Growth Areas of Littlehampton and Bognor Regis. Lower scale development, scalable according to relative impact, may be suitable in other areas of the District including Arundel, subject to other policies in the Local Plan. Excepting Permitted Development Rights or Local / Neighbourhood Development Orders, existing visitor attractions, facilities and accommodation (except holiday caravan sites), will only be granted planning permission for a change of use that continues a visitor offer unless: it is demonstrated that the use is no longer required and is unlikely to be reused or redeveloped for visitor purposes. This will include a clear demonstration of marketing, viability appraisal and the suitability of the site to accommodate the alternative use - using a methodology agreed by the District Council at pre-application advice stage. The Council will require evidence that the site has not been made deliberately unviable, that marketing has been actively conducted for a reasonable period of time and that alternative visitor uses have been fully explored.

Development quantum

The proposed development will result in the construction of a swimming pool complex and ancillary buildings and services to replace the existing site buildings. The existing buildings consist of a large number of accommodation structures. Therefore the development will result in the removal of the accommodation structures from a site that is more vulnerable to flooding from tidal and fluvial sources.

In line with previous Site wide Flood Risk Assessments, the Client will look to reinstate equal or fewer number of accommodation spaces in other areas of the Site where the flooding constraints do not exist, thereby promoting safer use of the land available.

5 FLOOD RISK – TO DEVELOPMENT

5.1 Overview

5.1.1 This section of the FRA describes the second and third stage of the Source-Pathway-Receptor model. This identifies the potential flood pathways to the proposed development, where a source and a pathway exists, the level of risk to the site is determined by considered both the consequence and likelihood.



5.1.2 Due to the variability of data availability and detail associated with each of the types of flooding, a qualitative risk assessment based on the probability and severity of flooding has been undertaken.

5.2 Flood Risk from Tidal Flooding to the Development

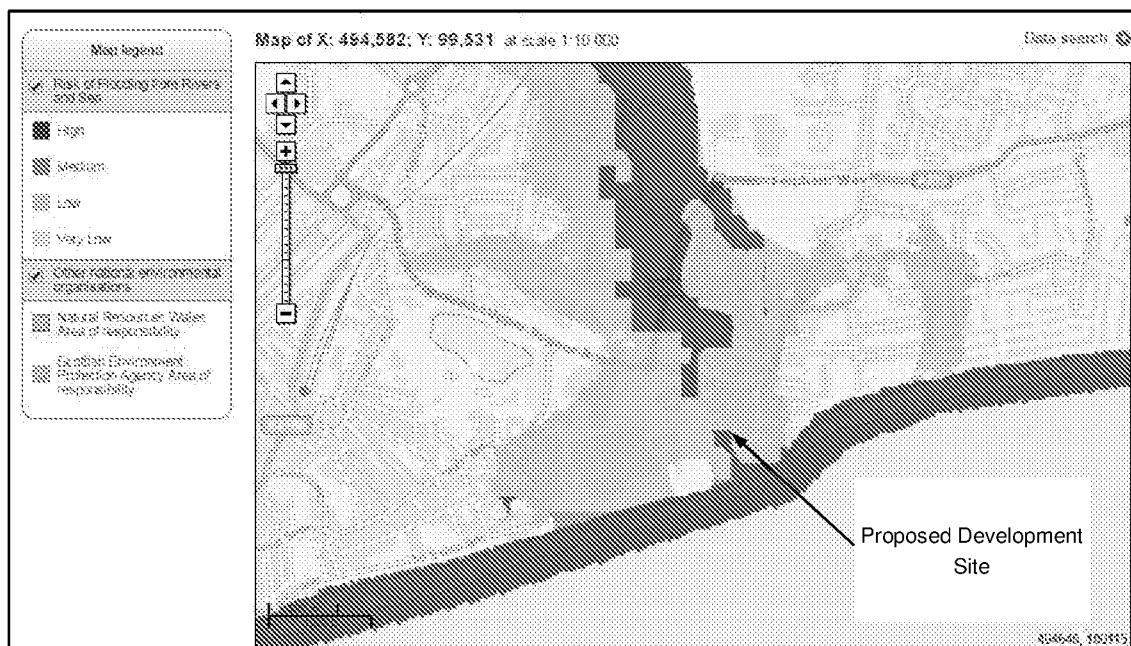
5.2.1 The Environment Agency Flood Map for Planning, which is duplicated in **Error! Reference source not found.**, indicates that the Site is in a high probability flood zone (Flood Zone 3) for flooding from sea. The latest prediction by the Environment Agency for the 1 in 200 year (0.5% probability) surge tide for this area (ignoring wave action) is 4.5m AOD. However, this does not take into account the tidal flood defences along the site boundary with the English Channel.

5.2.2 The Finished Floor Level (FFL) of the swimming pool is proposed to be approximately 3.0m AOD. However, the Butlin's Holiday Centre is protected by sea flood defence against a flood of 0.5% Annual Exceedance Probability (AEP), as stated within the SFRA. Due to the presence of flood defences (Appendix C) the site is not expected to be flooded from the sea within the 2056 or 2106 climate change affected time-horizons (assuming the existing defence standard remains), as stated within the SFRA.

5.2.3 In the case of wave overtopping or a breach in the sea defence wall, occupants of the swimming pool will be evacuated to areas of the building, or the Holiday Centre, that are elevated above 4.5m AOD. A Flood Emergency Plan will be developed in order to define the evacuation procedure.

5.2.4 With the existing sea defence standard taken into consideration, the risk of tidal flooding has been assessed to be **low** during the life time of the development. Recommended mitigation measures for the residual risk of wave overtopping or breach are discussed in Section 7.

Figure 5-1: Environment Agency River and Sea Flood Map



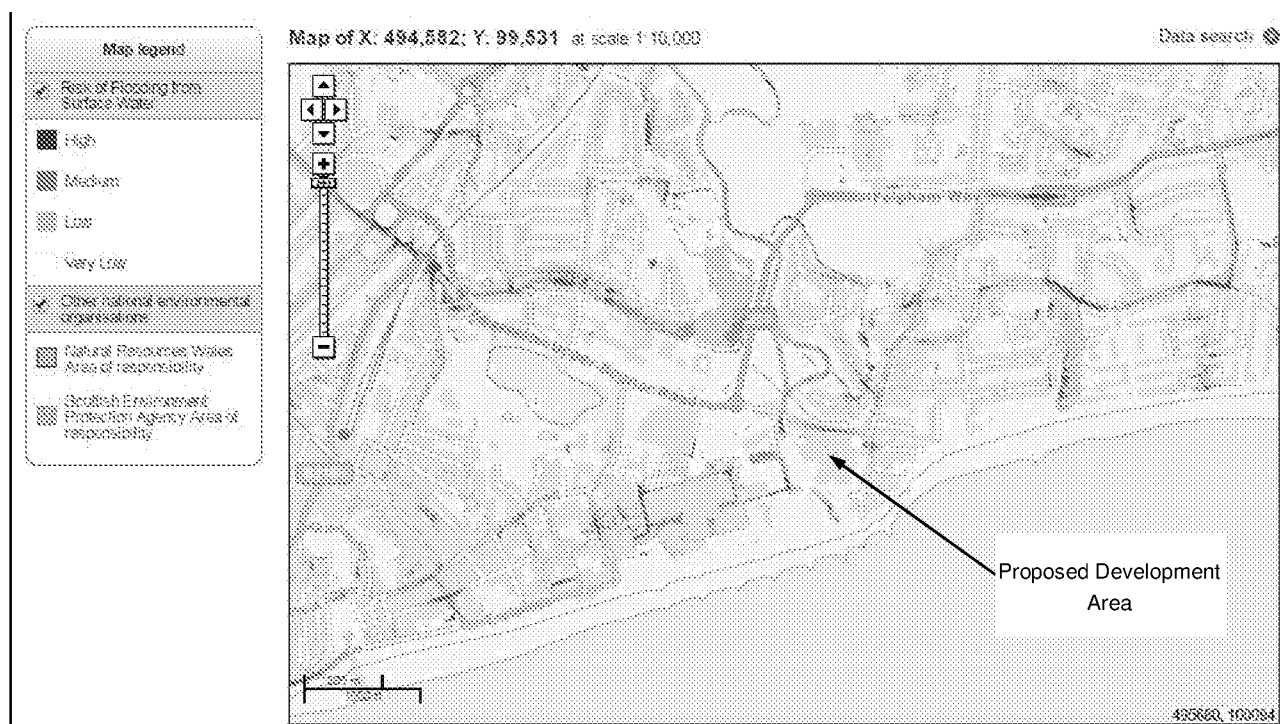
5.3 Flood Risk from Fluvial Flooding to the Development

- 5.3.1 The Environment Agency Flood Map for Planning indicates that the Site is located in a low probability zone (Flood Zone 1). According to the SFRA the fluvial flood extent is not expected to change significantly within the 2056 and 2106 time horizons.
- 5.3.2 The potential flood water level from the Aldingbourne Rife has been assessed to be at approximately 2.0m AOD for the 1 in 100 year event plus 20% increase in peak rainfall intensity for climate change. The Aldingbourne Rife can only discharge by gravity at the lower tidal levels and is pump assisted at other times. The ground level at the site ranges between approximately 2.2m to 3.05m AOD, sloping from the northeast to the southwest; therefore a comparison of fluvial flood levels and existing ground levels indicates that the Site is in Flood Zone 1.
- 5.3.3 Based on the EA consultation and information contained within the SFRA the fluvial flood risk to the proposed development has been assessed to be **low**, providing that ground levels are not reduced. No further mitigation is proposed.

5.4 Flood Risk from Overland Flow (Pluvial) Flooding to the Development

- 5.4.1 Overland flow (pluvial) has been identified as a potential source of flooding to the Site.
- 5.4.2 The risk of flooding from the Environment Agency Surface Water Flood Map¹² is presented in **Error! Reference source not found..** This mapping is produced at a strategic level to indicate where flooding from rainfall may occur, it does not fully represent surface water sewers, groundwater, ordinary watercourses or rivers.
- 5.4.3 The Site is generally shown on this mapping to have a very low risk of surface water flooding. This mapping highlights the presence of potential surface water flooding and overland flow routes on Upper Bognor Road to the north of the Site, and on the private road that extends close to the western boundary. Flood water from these two sources is unlikely to flow onto the Site, as a retaining wall extends along the northern boundary that enables floodwater on Upper Bognor Road to be confined to the highway and as the private road to the west is significantly lower than the Site.

Figure 5-2 : Environment Agency Surface Water Flood Map



¹² Environment Agency. 'Flood Map Risk of Flooding from Surface Water', available online at www.environment-agency.gov.uk. Accessed 29th August 2016.

- 5.4.4 The proposed development will mostly comprise hardstanding areas, therefore run-off on the Site is a potential issue. However, a new surface water drainage systems will be installed that will incorporate Sustainable Drainage Systems (SuDS) to enable rainfall generated during events with a return period of up to 1 in 100 years plus 40% climate change to be attenuated in order to minimise the risk of surface water flooding within the site.
- 5.4.5 With the new surface water drainage network taken into consideration, the risk of pluvial flooding has been assessed to be **low** during the life time of the development. Details of the proposed surface water drainage network are discussed in Section 8.

5.5 Flood Risk from Groundwater to the Development

- 5.5.1 The Arun District Council SFRA includes mapping of the whole District showing the Areas Susceptible to Groundwater Flooding (AStGWF), which is duplicated in Appendix C. The AStGWF is a strategic-scale map showing groundwater flood areas on a 1km square grid. The data was produced to annotate indicative Flood Risk Areas for Preliminary Flood Risk Assessment (PFRA) studies and allow the LLFAs to determine whether they may be at risk of flooding from groundwater. This data shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. The mapping indicates that 50% to 75% of the land within the 1km square that is occupied by the Site has geological and hydrogeological conditions indicate that groundwater might emerge. Hence, the SFRA indicates that the Site has potential for groundwater flooding, although no historic groundwater flooding incidences have been recorded on site.
- 5.5.2 The Ground Investigation Report by CJ Associates indicates that groundwater depths range between 2.04m and 2.77m. This investigation indicates the presence of an artesian type aquifer (a confined aquifer containing groundwater that will flow upward through a well) around 15m below ground level in both the underlying alluvial sand and chalk. If encountered the water is likely to rise to within a meter of ground level.
- 5.5.3 The proposed development will replace a series of chalets with large swimming pool, which incorporates a basement that will accommodate plant and water storage tanks. The proposed ground floor level will be above 3.0m AOD, which is higher than the highest anticipated groundwater level; therefore the lowest floor that is accessed by the general public will remain safe against groundwater seepage. However, the depth of foundation of the proposed building and the basement will extend below the existing foundation depth and the risk of groundwater flooding is considered to be **high**. Recommended mitigation measures are discussed in Section 7.

5.6 Flood Risk from Sewer Flooding to the Development

- 5.6.1 Southern Water sewers situated below roads that extend around the Site and a local surface water network serving the Site and have been identified as a potential source of sewer flooding to the Site.
- 5.6.2 Public sewer systems are typically designed for storm events up to a return period of 3.3% (1 in 30 years) based upon the recommendations provided in *Sewers for Adoption*¹³. The Site is generally elevated above the roads that extend to the north, east and south; therefore any flooding generated from public sewers is unlikely to enter the Site.
- 5.6.3 The design standard / capacity of the private surface water networks that extend through the Site is not known. An assessment of the capacity of the existing surface water drainage network that serves the Site has been undertaken in Section 8, and it is anticipated that the sewer is likely to surcharge during higher return period storms.
- 5.6.4 The proposed development will introduce a requirement for the existing private surface water drainage network to be removed and replaced with a new network that contains Sustainable Drainage Systems to accommodate surface water generated during rainfall events with a higher return period; therefore the risk of surface water sewer flooding within the Site will be reduced and the overall flood risk to the proposed development from sewer sources is considered to be **low**. No further mitigation measures are required.

¹³ Wrc (2012) 'Sewers for Adoption 7th Edition', WRC: Swindon.

5.7 Summary of Flood Risk to the Development

5.7.1 Table 5-1 presents a summary of flood risk to the development sites and whether further mitigation should be considered.

Table 5-1: Summary of Flood Risk to the Development

Flood Type	Source	Flood Risk	Mitigation recommended
Tidal Flooding	English Channel	Low	Yes
Fluvial Flooding	Aldingbourne Rife	Low	No
Surface Water (pluvial)	Intensive Rainfall	Low	Yes
Groundwater	Aquifer	High	Yes
Sewers	Public / Private Drainage	Low	No

6 FLOOD RISK – FROM DEVELOPMENT

6.1 Overview

- 6.1.1 As well as considering flood risk to the development, the NPPF¹ advises that a FRA should consider all potential sources of flooding arising from development.

6.2 Fluvial Flooding from the Development

- 6.2.1 A new development may increase fluvial flooding to surrounding areas by reducing the volume of storage within the floodplain, altering flood flow routes and / or modifying flood defences.
- 6.2.2 The Site lies within Flood Zone 1 for fluvial flooding; therefore works that introduce a requirement for site levels to be adjusted as part of the proposed development will not cause fluvial floodwater to be displaced.
- 6.2.3 The risk of increased fluvial flooding from the proposed development is therefore considered to be negligible and no further mitigation measures are required.

6.3 Surface Water Flooding from the Development

- 6.3.1 Greenfield sites benefit from natural drainage to convey or absorb rainfall. In general, development reduces the permeability of a site, and unmitigated, will increase the volume and rate of water running off the site to nearby watercourses or drainage systems, potentially increasing flood risk to downstream areas. Therefore appropriate drainage arrangements are required for new developments to ensure that flood risk to others is not increased.
- 6.3.2 The proposed development will allow the overall impermeable area to be reduced through the introduction of additional landscaping; therefore the volume of surface water that will be discharged to the Aldingbourne Rife will be reduced.
- 6.3.3 The proposed development also introduces a requirement for the existing private surface water network that extends though the Site to be removed and to be replaced by a new network that incorporates Sustainable Drainage Systems capable of accommodating rainfall generated during events with a return period of up to 1 in 100 years plus climate change. Assuming that this drainage network and associated Sustainable Drainage Systems are put in place, the increased surface water flood risk from the proposed development is considered to be **negligible**. No further mitigation measures are required other than the proposed drainage system as detailed in Section 8.

6.4 Sewer Flooding from the Development

- 6.4.1 Backwash from the swimming pool will be required to discharge to the Southern Water sewer network, which extends below the roads that surround the Site.
- 6.4.2 Storage tanks will be provided to enable the backwash to be released over an extended period in order to minimise the peak discharge to the foul sewer and reduce the risk of sewer flooding. This approach will also enable the chlorine concentration to be reduced by venting before the backwash is discharged to the sewer network. Conceptual foul drainage drawings are included within Appendix F to illustrate the location of the backwash tanks.
- 6.4.3 Assuming that storage tanks are provided to restrict the peak discharge from the swimming pool to the residual capacity of the receiving sewer, the increased sewer flood risk from the proposed development is considered to be **negligible**. No further mitigation measures are required.

6.5 Summary of Flood Risk from the Development

6.5.1 Table 6-1 presents a summary of flood risk to the proposed development and whether further mitigation should be considered.

Table 6-1: Summary of Flood Risk from the Development

Flood type	Source	Increased Flood Risk as a Result of the Proposed Development	Mitigation Recommended
Fluvial Flooding	Aldingbourne Rife	Negligible	No
Surface Water	Intensive Rainfall and Public / Private Drainage	Negligible	No, when taking into consideration the surface water drainage strategy
Sewer	Backwash from the swimming pool	Negligible	No, when taking into consideration storage tanks required to restrict the peak discharge to the residual capacity of the receiving sewer

7 MITIGATION OF FLOOD RISK

7.1 Overview

- 7.1.1 It has been identified that there is a residual flood risk to the Site from tidal and groundwater sources, therefore further mitigation is recommended. The following paragraphs describe mitigation measures that could be considered.

7.2 Protection Against Breach

- 7.2.1 The site is protected against tidal flooding by the sea defence wall. In the event of a breach or wave overtopping the defences, the maximum predicted tide level for a 1 in 200 year return period event is 4.5m AOD. The ground floor of the swimming pool is situated at approximately 3.0mAOD and plant rooms are situated within a basement.
- 7.2.2 The main structure of the swimming pool will be designed to resist loads imposed by floodwater in order to ensure that it does not collapse in the event of a tidal breach. Plant rooms will be constructed within concrete walls with flood gates to protect plant against flooding during any breach or overtopping. It is also recommended to locate electric power points above 4.5m AOD flood level, where possible, and to use an appropriate circuit breaker system to trip off the power system during flood events.

7.3 Emergency Plan

- 7.3.1 Swimming pool occupants should be evacuated if a tidal breach occurs. It is recommended that the evacuation procedure is documented in an Emergency Plan covering flood evacuation and escape routes and that an in house warning system is prepared. The approved Emergency Plan will be implemented in full from the date the new swimming pool is opened and it will be managed by swimming pool staff.
- 7.3.2 In the event of a flood, occupants of the swimming pool will be evacuated to areas within the swimming pool building, or other areas of the Holiday Centre that are elevated above the maximum predicted flood level (4.5m AOD).
- 7.3.3 The Environment Agency operates a flood warning service in all areas at risk of flooding. It consists of four flood warning codes from 'No Flood Warnings' to 'Severe Flood Warning' that indicate the level of danger. The flood warnings are disseminated through a variety of mediums that include TV, radio, an automated voice messaging service direct to a phone/fax/pager, the internet, Facebook, RSS feeds and/or loudhailer. There is also an emergency Flood line number (0845 988 1188) and a quick dial number for individual rivers. It is recommended that the swimming pool signs up to receive Flood Alerts issued by the Environment Agency, to ensure that the evacuation plan can be implemented with as much forewarning as possible.

7.4 Protection Against Groundwater Seepage

- 7.4.1 The site is situated within a high risk area for groundwater flooding. The ground flood slab will be installed above the highest anticipated groundwater level. In addition, the slab and basement plant room will be constructed using concrete mixes with an appropriate water resistant specification.
- 7.4.2 Measures will be taken in the foundation design to stop deeper groundwater from migrating upwards to the perched groundwater level. Pile design and construction methods will mitigate against the formation of a conduit between the two levels of groundwater.

8 SURFACE WATER DRAINAGE

8.1 Introduction

- 8.1.1 Appropriate drainage arrangements are required for new developments to ensure that flood risk to others is not increased.
- 8.1.2 Flood risk can be managed by minimising volumes and rate of surface water run-off from development sites through the use of sustainable urban drainage systems (SuDS). The Environment Agency and LLFA encourage the use of SuDS to prevent the water environment being adversely affected by increased surface water run-off and the increased risk of pollution and in particular diffuse pollution.
- 8.1.3 The Arun District Council Supplementary Requirements for Surface Water Drainage Proposals¹⁴ details the surface water drainage system requirements. The guidance states:
- “Discharge to a watercourse or surface water sewer must be restricted to the estimated mean greenfield runoff rate (Q_{bar}) by means of a controlled outflow (or restricted to existing runoff rates for brownfield sites). This can be derived from IH124 or a similar approved method. Any storage design must be submitted with groundwater monitoring data where applicable to ensure there will be no detrimental effect on the structure or storage. Storage areas are preferred to be in an ‘open’ form such as ponds, rather than underground tanks.”*
- 8.1.4 In addition this guidance states that: *“There must be provision to ensure that there is capacity in the system to contain the 1 in 100 year storm event plus 30% on stored volumes, as an allowance for climate change.”*
- 8.1.5 A preliminary assessment of the existing system and preliminary sizing for the proposed drainage system is detailed in the following paragraphs. It is understood that full detailed design of the drainage network will be undertaken prior to construction.

8.2 Existing Surface Water Drainage System

- 8.2.1 Limited information is available on the existing drainage system. Generally, the existing surface water drainage system comprises a network of carrier drains that collect surface water from existing buildings and external paved areas and convey surface water in a westerly direction across the Site, before discharging to the Aldingbourne Rife via a 225mm outfall. No attenuation storage or petrol interceptors have been identified within the Site.
- 8.2.2 It is not clear how run-off collects from the existing concrete bridge and car park that are situated on the western side of the Site. The Site topography and drainage survey would suggest that surface water from the concrete bridge discharges directly to the Aldingbourne Rife and that runoff from the area of land to the west of the bridge discharges off site to a drainage network that extends through the remainder of the Holiday Resort. A summary of the existing drainage areas is presented in Table 8-1.

Table 8-1: Summary of Existing Drainage Areas

Impermeable Area	Area (m ²)	Assumed Drainage End Point
Impermeable Area drained to the existing 225mm site outfall	19,340	Drainage channel
Impermeable area drained offsite	1,130	Drainage channel
Impermeable area drained directly to the River Rife	5,030	Drainage channel
Total	2,550	

¹⁴ Arun District Council Supplementary Requirements for Surface Water Drainage Proposals

8.2.3 As stated above, a single discharge location has been identified, which serves the entire Site area. The capacity of the existing outfall has been assessed and is tabulated in Table 8-2.

Table 8-2: Existing Surface Water Drainage Network Outfall Capacity

Parameter	Value	Unit	Notes
Diameter	225	mm	Details unknown, to be confirmed at detailed design
Gradient	1 in 250	-	Estimated based on manhole depth, as the existing network is blocked with silt.
Effective Roughness (Ks)	0.6	-	Adopted based on Sewers for Adoption ¹³ recommended value
Estimated Flow Capacity (Full Bore)	32.6	L/s	Adopted for preliminary assessment

8.2.4 To assess the existing drainage network, average rainfall intensity figures for Bognor Regis have been taken from MicroDrainage and used to calculate run-off generated within the Site for various storm events and return periods using the modified rational method. Results for 1, 2, 5, 30 and 100 year rainfall events are tabulated in Table 8-3.

8.2.5 The estimate run-off rates are calculated assuming an effective catchment area of 2.437 hectares, a run-off coefficient of 1 and using the average rainfall intensity for the storm duration under consideration. Peak rainfall rates are significantly higher during the peak of each storm, as such the run-off rates calculated represent a conservative value.

Table 8-3: Average Rainfall Intensities by Return Period

AEP (Return Period)	Average Rainfall Intensity (mm/hr)	Average Run-off Generated Within the Site (L/s)		
	60 min Storm	4 hour Storm	60 min Storm	4 hour Storm
100% AEP (1 in 1 year)	12.1	4.8	82	32
50% AEP (1 in 2 year)	15.3	6.0	104	41
20% AEP (1 in 5 year)	19.5	7.4	132	50
3.33% AEP (1 in 30 year)	29.2	11.0	198	74
1% AEP (1 in 100 year)	38.4	14.3	260	97

8.2.6 Within Table 8-3 the calculated run-off rates from the site have been colour coded as follows:

- The rates highlighted in orange represent those which exceed the capacity of the outfall.
- The rates highlighted in green represent those within the capacity of the outfall.

8.2.7 It can be seen that run-off generated from the existing site during 60 minute duration storms and rainfall events with a return period of greater than 1 in 1 years is in excess of the capacity of the existing outfalls under full bore conditions. It is therefore considered likely that these pipes are surcharged during higher return period storms, which may also give rise to uncontrolled flooding on the site.

8.2.8 No attenuation devices have been identified on the Site. Hence water will back up in the pipework and flood onto the surface once the capacity of the surface water drainage system has been exceeded. When this occurs, flood water will pond or flow overland to exit the Site in an uncontrolled manner via the low points on the Site boundary.

8.2.9 Based upon the above calculations, it can be concluded that the Site is currently susceptible to flooding from surface water run-off generated within the Site, with uncontrolled ponding and overland flow of flood water likely to occur on a regular basis.

8.3 Proposed Surface Water Management

- 8.3.1 The site investigation indicates that underlying strata are unsuitable for infiltration; therefore surface water is proposed to be discharged to the Aldingbourne Rife in order to maintain the existing drainage regime. The new surface water drainage network is proposed to incorporate Sustainable Drainage Systems in order to enable the peak discharge rate for rainfall events with a return period of up to 1 in 100 years plus 40% climate to be restricted to the mean annual runoff rate, Q_{bar} , in order to comply with the requirements of the Arun District Council Supplementary Requirements for Surface Water Drainage Proposals. An additional 40% allowance will be made for climate change on the 100 year event to comply with the requirements of the Environment Agency Flood Risk Assessment Climate Change Allowances guidance¹⁴
- 8.3.2 Calculations have been prepared in accordance with the FSR methods defined within the Interim Code of Practice for SuDS to estimate the mean annual runoff rate, Q_{bar} . The results of these calculations are provided within Appendix E, which indicate that Q_{bar} is 23.5l/s, based upon an impermeable area of 2.437 hectares.

8.4 Attenuation Storage

- 8.4.1 Attenuation storage is provided to allow the discharge from a development to be controlled to permitted run-off rates. A computer model of the surface water drainage for the proposed development has been constructed using the Source Control module of Microdrainage software. The model has been subjected to simulated rainfall events for the 1 in 100 year event, with 40% allowance for climate change to demonstrate that sufficient attenuation storage will be provided to enable the peak run-off rate from the proposed development to be reduced to the mean annual runoff rate, Q_{bar} , for the storm return periods simulated. Outputs from this model are included within Appendix F.
- 8.4.2 The results of this analysis indicate that approximately 905 m³ of attenuation storage is required to reduce the run-off from the impermeable areas on the proposed development to the mean annual runoff rate, Q_{bar} , for the existing Site for a rainfall event with a return period of 1 in 100 years plus climate change.
- 8.4.3 Considering, the development requirements and Site topography it is envisaged that the attenuation storage could be provided within the following Sustainable Drainage System features, as illustrated on design drawings contained within Appendix F:-
- Porous paving within the bays of car parks that are constructed at grade to enable runoff from the whole car park to be attenuated and for urban pollutants to be removed at source;
 - A shallow cellular storage system on the roof of the decked car park that enables runoff rates from this large area to be reduced; and
 - Geo-cellular storage tanks positioned below landscaped areas adjacent to the swimming pool to attenuate runoff from the swimming pool roof.
- 8.4.4 The relatively dense nature of the proposed development and the requirement for landscaped areas to be used for recreational purposes precludes the provision of open storage features, such as swales, detention basins and retention ponds.

8.5 Long Term Storage

- 8.5.1 Long term storage is required to mitigate the additional volume of run-off generated by an increase in impermeable area.
- 8.5.2 Long term storage devices prevent the additional volume of run-off from being discharged to the watercourse by directing surface water run-off to ground. Alternatively, if this is not possible due to soil conditions, surface water run-off should be attenuated and discharged at very low rates, which do not exceed 2 l/s/ha.
- 8.5.3 The proposed development will enable the percentage impermeable area to be reduced from 82% to 70% through the provision of additional landscaping; therefore Long Term Storage will not be required.

9 CONCLUSION

- 9.1.1 A Level 2 FRA has been prepared through the completion of the objectives set out in Section 1.5. This FRA has concluded:

9.2 Planning Policy

- 9.2.1 In accordance with the flood risk vulnerability table, the development is classified as 'Less Vulnerable' and is permitted within all flood zones without need for the Exception Tests to be undertaken.

9.3 Development Occupancy

- 9.3.1 The Site that is proposed to be redeveloped to accommodate the Butlins Splash swimming pool is currently occupied by a significant quantum of existing staff and guest accommodation, a total of 1005 bed spaces. In the event that planning consent is granted and the swimming pool is constructed, then the occupancy rate within the Butlins Bognor Regis resort is likely to be temporarily reduced, by 1005 bed spaces.
- 9.3.2 The Flood Risk Assessment that was prepared in November 2010 to support an application for a new hotel on the Bognor Regis resort contains correspondence from the Environment Agency within Appendix C, which indicates that development on the Bognor Regis site is based on the principle that there would be no overall increase in occupancies (i.e. the status quo with respect to the number of beds is maintained) in order to mitigate the residual risk of tidal flooding.
- 9.3.3 Based on this previous assessment, Bourne Leisure reserve the right to submit future applications to seek consent to reinstate the quantum of accommodation that is present on the Site prior to the construction of the swimming pool, by the 1005 bed spaces removed. These applications will ensure that habitable accommodation is positioned above the 1 in 200 year tide surge level in order to mitigate the residual risk of tidal flooding. This overall approach will enable the Bognor Regis site to be redeveloped in a sustainable manner, by ensuring that the risk of flooding to habitable accommodation is reduced.

9.4 Flood Risk – To the Development

- 9.4.1 There is considered to be no risk of flooding to the proposed development from artificial sources.
- 9.4.2 Flood risks to the proposed development from tidal and fluvial flooding have been assessed as **low**.
- 9.4.3 Overall flood risk to the proposed development from pluvial and sewer sources are considered to be **low**.
- 9.4.4 There is considered to be a **high** risk of flooding from groundwater.

9.5 Flood Risk – From the Development

- 9.5.1 The increased fluvial and surface water flood risk from the proposed development is considered to be **negligible**.

9.6 Flood Risk Mitigation

- 9.6.1 The site is protected against tidal flooding by the sea defence wall. In the event of a breach or wave overtopping the defences, the maximum predicted tide level for a 1 in 200 year return period event is 4.5m AOD, which is higher than the level of the ground floor and plant rooms that are situated within the basement. The main structure of the swimming pool will be designed to resist loads imposed by floodwater in order to ensure that it does not collapse in the event of a tidal breach. Plant rooms will be constructed within concrete walls with flood gates to protect plant against flooding during any breach or overtopping. It is also recommended to locate electric power points above 4.5m AOD flood level, where possible, and to use an appropriate circuit breaker system to trip off the power system during flood events.
- 9.6.2 It is recommended that a Flood Emergency Plan be developed, which will detail the route of egress in the event of a flood to enable occupants of the swimming pool will be evacuated to areas within the swimming pool building, or other areas of the Holiday Centre that are elevated above the maximum predicted flood level (4.5m

AOD). It is also recommended that the swimming pool signs up to receive Flood Alerts issued by the Environment Agency, to ensure that the evacuation plan can be implemented with as much forewarning as possible.

- 9.6.3 The site is located within a high risk area for groundwater flooding and the ground floor slab will be installed above the highest anticipated groundwater level. To mitigate the risk of groundwater seepage, the slab and basement plant room will be constructed using concrete mixes with an appropriate water resistant specification. Measures will also be taken in the foundation design to stop deeper groundwater from migrating upwards to the perched groundwater level. Pile design and construction methods will mitigate against the formation of a conduit between the two levels of groundwater.

9.7 Surface Water Drainage Strategy

- 9.7.1 A surface water drainage system has been proposed, which will incorporate Sustainable Drainage Systems in the form of porous paving within car parks, shallow cellular storage on the deck of car park and geo-cellular storage below landscaped areas surrounding the swimming pool. These features will enable water quality to be improved and they will provide sufficient attenuation storage to enable the peak discharge during rainfall events with a return period of up to 1 in 100 years plus 40% climate change to be restricted to the mean annual runoff, Q_{bar} .
- 9.7.2 The proposed surface water drainage network will reduce flood risk to and from the proposed development, as the proposed Sustainable Drainage Systems will enable runoff rates to the Aldingbourne Rife to be reduced, whilst permitting excess surface water generated during extreme events to be stored within Sustainable Drainage Systems constructed as an integrated part of the development.