South Downs National Park Authority

Water Cycle Study and SFRA Level 1

Scoping and Outline Report



AMEC Environment & Infrastructure UK Limited

April 2015

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Document Revisions

No.	Details	Date
1	Draft Scoping Study	24/06/2014
2	Draft Scoping and Outline Water Cycle Study with draft Level 1 SFRA	19/12/2014
3	Draft Scoping and Outline Water Cycle Study with draft Level 1 SFRA – for issue to steering group	29/01/2015
4	Final Scoping and Outline Water Cycle Study with draft Level 1 SFRA	10/04/2015

South Downs National Park Authority

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AMEC Environment & Infrastructure UK Limited

April 2015

Report for

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Doc Reg No. R032i4

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Executive Summary

Purpose of this Report

This report has been produced for the purpose of helping the South Downs National Park Authority (SDNPA) progress it's Local Plan and to establish the constraints to development from existing environmental and water infrastructure capacity. The purpose of this is to provide an informed platform for discussion between the SDNPA development planners, the local councils (with regard to non-strategic development plans), the Environment Agency, and the appropriate water and wastewater service providers (in this case Southern Water, South East Water, Portsmouth Water, and Thames Water), plus other stakeholders. This report is aimed specifically for use by the SDNPA but recognises that the information within it will also be of interest to neighbouring Local Authorities whilst they develop their own Local Plans.

This report recognises that development is necessary and that whilst these parties have different priorities and responsibilities they have a shared objective in terms of facilitating growth that is sustainable in terms of environmental and water infrastructure conditions.

This report has been commissioned and funded by SDNPA to provide an evidence base for its development programme. From the outset the study has been supported by the Environment Agency, Southern Water, South East Water, Portsmouth Water, Brighton and Hove Council, East Sussex Council, West Sussex Council, and Hampshire County Council. Due to the small size of the study area within Thames Water's border Thames Water has contributed to a minor extent. All parties understand that their planning cycles have developed independently from one another and agree that the Water Cycle Study provides a mechanism to "*understand and take account of each other's processes, practices and issues in order to promote the efficient and sustainable delivery of infrastructure*"[1].

The information used in this study includes data and reports published by SDNPA, the Environment Agency, and the water companies, plus data and commentary submitted by the parties specifically to inform the study. It is assumed that all information and documents provided to AMEC by the client in connection with the preparation of this report are accurate, complete and not misleading.

It is assumed that this report could be made publicly available, although not necessarily so. Third parties should be aware that this report is based on technical data and analyses but it is not intended to be a detailed technical document. Interested third parties should not use the content as an alternative to referencing the original data material and with regard to external parties' development plans it should be used as a starting point to support rather than by pass discussions with the South Downs National Park Authority.

[1] Environment Agency. Water Services Infrastructure Guide: A Planning Framework

Contents

Glossary

AEP	Annual Exceedance Probability	Probability of exceeding a specified flow or level in any year (inverse of the return period for an annual maximum series).
AMP	Asset Management Period	Five year period in which water companies implement planned upgrades and improvements to their asset base. Activities are subject to funding review. AMP6 is due to run from 2015 to 2020.
ANG	Access Network and Accessible Natural Greenspace	Study providing evidence in support of both the South Downs National Park Management Plan and Local Plan, by analysing the access network and elements of the green infrastructure (GI) network.
CAMS	Catchment Abstraction Management Strategy	The assessment of how much water can be extracted to meet its many economic uses – agriculture, industry, and drinking water supply – while leaving sufficient water in the environment to meet ecological needs.
CLG	Communities and Local Government	Communities and Local Government sets policy on local government, housing, urban regeneration, planning and fire and rescue.
CFMP	Catchment Flood Management Plan	A strategic planning tool through which the Agency will seek to work with other key decision-makers within a river catchment to identify and agree policies for sustainable flood risk management.
Defra	Department for Environment, Food and Rural Affairs	Department that brings together the interests of farmers and the countryside; the environment and the rural economy; the food we eat, the air we breathe and the water we drink.
DG5	Performance Indicator no 5, 'Flooding from sewers'	Water sewerage undertakers report to Ofwat their assessment of the number of properties at risk of flooding because of overloaded sewers under two categories: once every ten years; twice or more every ten years. These are further categorised as faults due to overloaded sewers or temporary causes.
DO	Deployable Output	The output of a source of group of sources or of bulk supply once environmental, licensing, and infrastructure, and demand constraints are taken into account.
DPD	Development Plan Document	Details the spatial representation of housing and employment land allocations in response to the regional spatial strategy.
DWF	Dry Weather Flow	The measure of the flow influx to a WwTW derived from human activity (both domestic and trade), but excluding any storm-induced flows.
DYAA	Dry Year Annual Average	The cumulative demand for water in a dry year (as defined by the water company) divided by the number of days in the year. This enables demand assessment taking into account fluctuations throughout the year.
DYCP	Dry Year Critical Period	The average daily demand for water during defined critical period, e.g. one seventh of total demand during the 'peak week' in a 12 month period. The nature of the Critical period can vary between companies and is defined by each company.
EA	Environment Agency	A government body that aims to prevent or minimise the effects of pollution on the environment and issues permits to monitor and control activities that handle or produce waste. It also provides up-to-date information on waste management matters and deals with other matters such as water issues including flood protection advice.
FAS	Flood Alleviation Scheme	Schemes to reduce the risk of flooding. FAS are delivered under the government's flood and coastal resilience partnership funding policy, which was introduced in May 2011.
GIS	Geographical Information System	A system for capturing, storing, analysing and managing data and associated attributes which are spatially referenced to the earth.
HD	Habitats Directive	The Habitats Directive (together with the Birds Directive) forms the cornerstone of Europe's nature conservation policy. It is built around two pillars: the Natura 2000 network of protected sites and the strict system of species protection.

IDB	Internal Drainage Board	An operating authority which is established in areas of special drainage need in England and Wales with permissive powers to undertake work to secure clean water drainage and water level management within drainage districts.
LDF	Local Development Framework	A folder of local development documents that outlines how planning will be managed in the area.
LLFA	Lead Local Flood Authority	LLFAs are county councils and unitary authorities. LLFAs are responsible for a range of tasks required to prepare and maintain a strategy for local flood risk management in their areas.
l/p/d	Litres per head per day	A unit for measuring the amount of water consumed and waste flow from households.
LPA	Local Planning Authority	The local authority or council that is empowered by law to exercise planning functions. Often the local borough or district council. National parks and the Broads authority are also considered to be local planning authorities. County councils are the authority for waste and minerals matters.
MDO	Minimum Deployable Output	This is used to assess the period where available supplies are expected to be at their lowest or most stressed. This normally occurs during late summer/early autumn when river flows are at their minimum following the summer, and groundwater levels are at their lowest prior to the onset of winter recharge.
NPPF	National Planning Policy Framework	The National Planning Policy Framework is a key part of the government's reforms to make the planning system less complex and more accessible. It sets out the Government's national policies on development and flood risk. The policies in these statements apply throughout England and focus on procedural policy and the process of preparing local development documents. The framework acts as guidance for local planning authorities and decision-takers, both in drawing up plans and making decisions about planning applications.
OFWAT	The Water Services Regulation Authority	The Water Services Regulation Authority. Ofwat regulates how much money a water company can is required to spend over each five year planning period, and regulate the amount of money the water companies can charge from their customers.
pcc	Per capita consumption	Term referring to the amount of water consumed per person per day (typically refers to consumption of water as provided by a water utility company).
PFRA	Preliminary Flood Risk Assessment	PFRAs are the first of 4 stages in a 6 year planning cycle to manage flood risk. A PFRA is an assessment of floods that have taken place in the past; and floods that could take place in the future. PFRA considers flooding from surface water runoff, groundwater and ordinary watercourses. The PFRAs are used to identify areas that are at risk of significant flooding. These areas are called flood risk areas. Lead local flood authorities are responsible for and have prepared the PFRAs and identified the flood risk areas.
PR	Periodic Review (for water companies' investment plans)	One of Ofwat's main tasks is to set price limits for the water and sewerage companies in England and Wales. Ofwat do this in order to protect consumers from the monopoly providers of these services. However it is also their duty to enable efficient companies to finance their functions. They make sure that consumers receive reliable services and value for money and that each company is able to meet its environmental obligations now and in the future. Price limits are reviewed every five years. Prices were set at the price review in 2004 for the 2005 – 2010. The last price review (PR09) covers the five years from April 2010 to March 2015.
PW	Portsmouth Water	A water supply only company serving approximately 660,000 domestic customers plus as well as many important industries, large defence establishments and varied commercial businesses. The supply area extends through South East Hampshire and West Sussex.
Ramsar	The Convention on Wetlands of International Importance, called the Ramsar Convention	Intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Named after the Iranian city of Ramsar, where the treaty was signed in 1971.
RBMP	River Basin Management Plan	The River Basin Management Plans describe the river basin district, and the pressures that the water environment faces. It shows what this means for the current state of the water environment in the river basin district, and what actions will be taken to address the pressures in line with the requirements of the Water Framework Directive. It sets out what improvements are possible by 2015.

SAC	Special Area of Conservation	A site designated under the European Community Habitats Directive, to protect internationally important natural habitats and species.
SAMP	Strategic Asset Management Plan	Guides the purchase, use, maintenance, and disposal of assets required in order to conduct business.
SDLP	South Downs Local Plan	The Local Plan will set out how the National Park will develop into the future.
SDNP/A	South Downs National Park / Authority	The South Downs National Park Authority (SDNPA) is the organisation responsible for promoting the purposes of the National Park and the interests of the people who live and work within it.
SEW	South East Water	A supply only water company serving 2.1 million customers in Kent, Sussex, Surrey, Hampshire and Berkshire.
SFRA	Strategic Flood Risk Assessment	Document that informs the planning process of flood risk and provides information on future risk over a wide spatial area. It is also used as a planning tool to examine the sustainability of the proposed development allocations.
SHLAA	Strategic Housing and Land Availability Assessment	A key component of the evidence base to support the delivery of sufficient land for housing to meet the community's need for more homes. These assessments are required by national planning policy.
SMP	Shoreline Management Plan	Shoreline management plans are developed by Coastal Groups with members mainly from local councils and the EA. They identify the most sustainable approach to managing the flood and coastal erosion risks to the coastline in the: short-term (0 to 20 years); medium term (20 to 50 years); and long term (50 to 100 years).
SPA	Special Protection Area	Sites classified under the European Community Directive on Wild Birds to protect internationally important bird species.
SSSI	Site of Special Scientific Interest	A site identified under the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000) as an area of special interest by reason of any of its flora, fauna, geological or physiographical features (basically, plants, animals, and natural features relating to the Earth's structure).
SuDS	Sustainable Drainage Systems	Sustainable drainage systems or sustainable (urban) drainage systems: a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques (may also be referred to as SDS).
SWMP	Surface Water Management Plan	A framework through which key local partners with responsibility for surface water and drainage in their area work together to understand the causes of surface water flooding and agree the most cost effective way of managing surface water flood risk.
SWS	Southern Water (Services)	A water supply and sewerage undertaker. Provides sewerage and wastewater treatment services across in Hampshire, the Isle of Wight, West Sussex, East Sussex and Kent, and water supply services across half of this area.
TWUL	Thames Water (Utilities Ltd)	The UK's largest water and wastewater services company providing water supplies to 9 million customers, and wastewater services to 15 million people.
UKCIP	United Kingdom Climate Change Impacts Programme	Mainly funded by the Department for Environment, Food and Rural Affairs it helps co-ordinate scientific research into the impacts of climate change, and helps organisations adapt to those unavoidable impacts.
WCS	Water Cycle Study	A study aimed at ensuring that future development is sustainable in terms of flood risk management, water quality and water supply.
WFD	Water Framework Directive	A European Union directive which commits member states to making all water bodies (surface, estuarine and groundwater) of good qualitative and quantitative status by 2015.
WRMP	Water Resource Management Plan	Plan prepared by water supply undertakers every 5 years outlining how they aim to meet predicted demand for water over the next 25 years.
WRZ	Water Resource Zone	Defined by the water supply/demand balance in the region such that all customers within it receive the same level of service in terms of reliability of water supply.
WwTW	Wastewater Treatment Works	Separates solids from liquids by physical processes and purifies the liquid by biological processes. Discharge from Wastewater Treatment Works may contain a range of pollutants and need to be carefully monitored.

1. Introduction

1.1 Background and purpose

The South Downs National Park (SDNP) is England's newest National Park, having become fully operational on 1 April 2011. The South Downs National Park Authority (SDNPA) is responsible for promoting the statutory purposes of the National Park and the interests of the people who live and work within it. The SDNPA is in the process of developing its Local Plan for the South Downs National Park and recognises that water is an important strategic issue that needs to be understood and the implications taken into account in the development plans. The SDNPA commissioned AMEC to undertake a Water Cycle Study and Level 1 Strategic Flood Risk Assessment (SFRA) to support decisions on where and when housing growth should be targeted and to inform water related policies that may be included in the Local Plan.

1.2 Development in the South Downs

Historically, housing numbers in the South Downs have increased by around 250 per year and it is a continuation of this trend that is expected in relation to population growth and demand for housing in the area. The authorities do not intend to deliberately increase, decrease, or accelerate growth different to the historic trend. However, the authorities do intend to plan ahead, specifying the locations where appropriate levels of growth could be approved. To this end the SDNPA is developing the South Downs Local Plan (SDLP) which will cover the whole of the National Park over the period to 2032. Over and above its overall Duty to Co-operate, SDNPA is carrying out joint working with a number of Local Authorities within the area in the preparation of planning policy documents and the authorities are working together to develop their Local Plans in relation to one another and the overarching position of the SDNPA[2]:

- Wealden District;
- Lewes District;
- Winchester District;
- East Hampshire District; and
- Mid Sussex District.

The local planning authorities are at various stages in their Local Development Framework/Local Plan processes. Most are between consultation and examinations in public of their Core Strategies and most do not have finalised housing figures or specific locations for major housing development. When the SDNPA was formed it was agreed with the Local Authorities that SDNPA would take responsibility for planning and dealing with applications for strategic developments across the South Downs region and that the individual Local Authorities would retain their

[2] http://www.southdowns.gov.uk/planning/planning-policy/joint-working-with-local-authorities

focus on dealing with applications for smaller scale developments. During 2013 the SDNPA prepared its Access Network and Accessible Natural Greenspace (ANG) study which included analysis snapshot of the main development areas in the region. In advance of that study strategic growth sites were defined as having a minimum of 100 development units. The Local Authorities consider sites with more than 20 development units to be strategic, and so for the purpose of this study this scale of development is referred to as smaller-scale strategic development. There are also unexpected applications for individual developments which are not identified by the planning process. These 'windfall' sites are generally small, infill sites within the urban area.

This report encompasses the outcomes of a two-tier study:

- **Scoping**: The Water Cycle Scoping Study uses data collated by South Downs from the Local Authorities as published within the Access Network and Accessible Natural Greenspace (ANG) study (January 2014) and reviewed taking into account the East Hampshire District Council SHLAA data that was released following the ANG. It includes development sites within the National Park boundary and within a 2km buffer area, it also recognises the strategic development sites in the local authority areas intersecting the National Park area (i.e. these sites are not duplicated within the development datasets);

- The **Outline** Study and Level 1 Strategic Flood Risk Assessment (SFRA) builds upon and updates this using the more detailed Strategic Housing and Land Assessment Availability (SHLAA) data provided at the time of analysis and focuses on the potential constraints to growth to sites specifically within the National Park.

The main drivers for the combined Water Cycle Study (which is voluntary) and the SFRA (mandatory under the National Planning Policy Framework, NPPF) are the requirements of NPPF and the SDNPA Partnership Management Plan. These planning documents have two key objectives:

1. To increase capacity for growth in the SDNP;

2. To improve sustainability in the SDNP.

1.3 Aims and objectives

The purpose of this study is to provide the SDNPA (and stakeholders) with a document that clearly demonstrates an appropriate level of consideration and investigation into the water issues that could constrain development and influence Local Plan policies. The outcomes from the study will support SDNPAs requirements that:

- Development only occurs within environmental constraints;

- Development occurs in the most sustainable location;

- Relevant water cycle infrastructure is in place before development; and

- Opportunities for more sustainable infrastructure options are realised.

The WCS and SFRA are two core pieces of evidence to support the Local Plan. The specific objectives are to:

- Assess the capacity of current water infrastructure to accommodate required growth without adversely affecting the environment by considering:
  - The availability of water resources and the supply network;
  - The capacity of existing wastewater infrastructure and the drainage network;
  - The environmental capacity of receiving watercourses to receive wastewater; and
  - The potential of development to increase flood risk.
- Determine the potential impact of proposed development in the context of environmental legislation including the Water Framework Directive (WFD), Habitats Directive (HD), and any other relevant water or statutory planning policy;
- Identify the infrastructure necessary to achieve proposed growth within the constraints of the environment and legislation; and
- Develop a strategy for a phased approach to development that allows key growth targets to be met whilst providing sufficient time for the identified infrastructure to be adopted.

1.4 How to use this report

This report incorporates a Scoping Assessment followed by an Outline Assessment with a Level 1 SFRA (section 1.5 defines the various stages of water cycle study). The Outline Assessment supports a development strategy which presents conclusions on the implications for growth and is intended to help the SDNPA progress its Local Plan and facilitate timely interactions with the water utilities, Environment Agency, developers, and other stakeholders. A steering group consisting of the water utility companies; Environment Agency; and the County Authorities of: East Sussex, West Sussex, Brighton and Hove, and Hampshire have been involved to review the planning assumptions and the technical assessments (section 1.7.3). These underpin the strategy which has been accepted as a proposal by the SDNPA.

This report is aimed specifically for use by the SDNPA but recognises that the information within it will also be of use to the Local Authorities whilst they develop their own Local Plans. Development sites outside of the National Park boundary which are examined (i.e. in Scoping) are taken from the local authorities' planning data, i.e. they are not duplicate sites. This is done to assess the interrelationship between growth in the National Park, growth in the neighbouring area, and the shared water infrastructure and water environment.

Each District and Borough are at different stages developing their Local Development Framework/Local Plans and very few have approved joint core strategies[3]. This inevitably means that the planning data (locations and estimated

[3] Access and Network Greenspace Study, Appendix (January 2014).

dwelling numbers) may be subject to change over time. This study is designed to reflect the need for assessments which can be interpreted as planning options and priorities evolve.

- Chapter 1 sets out the rationale for this study, the long term development plans and water related sustainability objectives;
- Chapter 2 describes the water cycle and sets out the concepts of integrated water management and the relevant water management legislation;
- Chapter 3 presents the results of the Scoping Assessment: water resources and supply, wastewater treatment and sewerage. The base line flood risk characterisation is incorporated within the SFRA in Chapter 5;
- Chapter 4 presents the results of the Outline Assessment of water resources and wastewater treatment capacity;
- Chapter 5 presents the Level 1 SFRA in relation to the SHLAA data provided in September 2014;
- Chapter 6 presents a proposed development strategy indicating a phased approach that the SDNPA may wish to consider, and the actions that are likely to be required to support the longer term growth proposals up to 2032.

A 'traffic light' system is used to visually present the constraints assessments in each topic area. The key for the traffic light system is as follows:

	Development ok, no constraints identified
	Development may be ok, some constraints identified, minor mitigation required to meet the proposed growth
	Constraints identified, development may be ok with major mitigation to meet growth targets
	Advise development site is not taken forward due to major constraint / unsustainable solutions

1.5 National Guidance on WCS and SFRA

The Environment Agency issued a National Guidance document[4] to ensure that water cycle studies are carried out in a consistent way. This guidance outlines the required approach for the Scoping, Outline, and Detailed phases of water cycle studies.

The National Guidance on Water Cycle Studies indicates that the assessment should be carried out in three phases:

[4] http://publications.environment-agency.gov.uk/pdf/GEHO0109BPFF-e-e.pdf

- **Scoping**: The primary aim of the Scoping Assessment is to collate and review existing information (e.g. previous studies and monitoring data) on the water environment within the study area, identify development plans and engage with key stakeholders, including the Environment Agency, water companies and drainage authorities, to identify key issues that require consideration in the following stages of the work;

- **Outline**: The primary aim of the Outline Assessment is to identify potential environmental and water infrastructure constraints to development to provide an evidence base to support the Local Plan and identification of preferred sites for development. The SDNPA Strategic Housing and Land Availability Assessment (SHLAA) data is applied during Outline Assessment enabling second phase assessments to relate the issues more specifically to proposed development sites. This level of information is particularly important for SFRA. It is recommended that the study identify areas of uncertainty that may require further detailed studies if necessary;

- **Detailed**: The Detailed Assessment aims to resolve areas of uncertainty identified in the Outline Assessment through further more detailed studies. It identifies what water cycle management measures and infrastructure are needed, where and when they are needed, who is responsible for providing the systems, and by what deadline. This may involve an assessment of the costs and benefits of options. It also provides guidance to the local authorities to facilitate implementation and funding of the Strategy. **This study does not include a Detailed Assessment.**

In March 2014 the government published online national guidance on undertaking Strategic Flood Risk Assessments (SFRAs)[5]. The guidance states that a SFRA should be:

"carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future, taking account of the impacts of climate change, and to assess the impact that land use changes and development in the area will have on flood risk."

In particular, a SFRA should refine the information available on the Environment Agency's national scale risk maps, and determine how the degree of flood risk from each source varies across the study area. The SFRA should provide information and policy guidance to inform the sustainability of the local plan, to ensure that flood risk is managed and does not increase as a result of future development. The SFRA should provide guidance on the application of the NPPF Sequential and Exception Tests. As a result of the analysis undertaken, guidance should be provided on the scope and requirements of Flood Risk Assessments (FRAs) at identified sites. Where possible, the SFRA should also identify opportunities to reduce flood risk to existing communities. Flood risk implications to emergency planning should also be considered. In preparing the plan, the local authority should consult with the Environment Agency, the Lead Local Flood Authority and the relevant sewerage undertaker.

A Level 1 SFRA provides a first pass assessment of flood risk. For authorities with limited development pressures and/or where flood risk is not a major issue only a Level 1 SFRA may be required. The main task of the Level 1 SFRA is to apply the Sequential Test. If further detailed assessment of flood risk is required, a Level 2 SFRA should

[5] http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/strategic-flood-risk-assessment

be prepared examining flood risk at the identified locations, allowing a more detailed application of the Sequential Test, and if required applying the Exception Test.

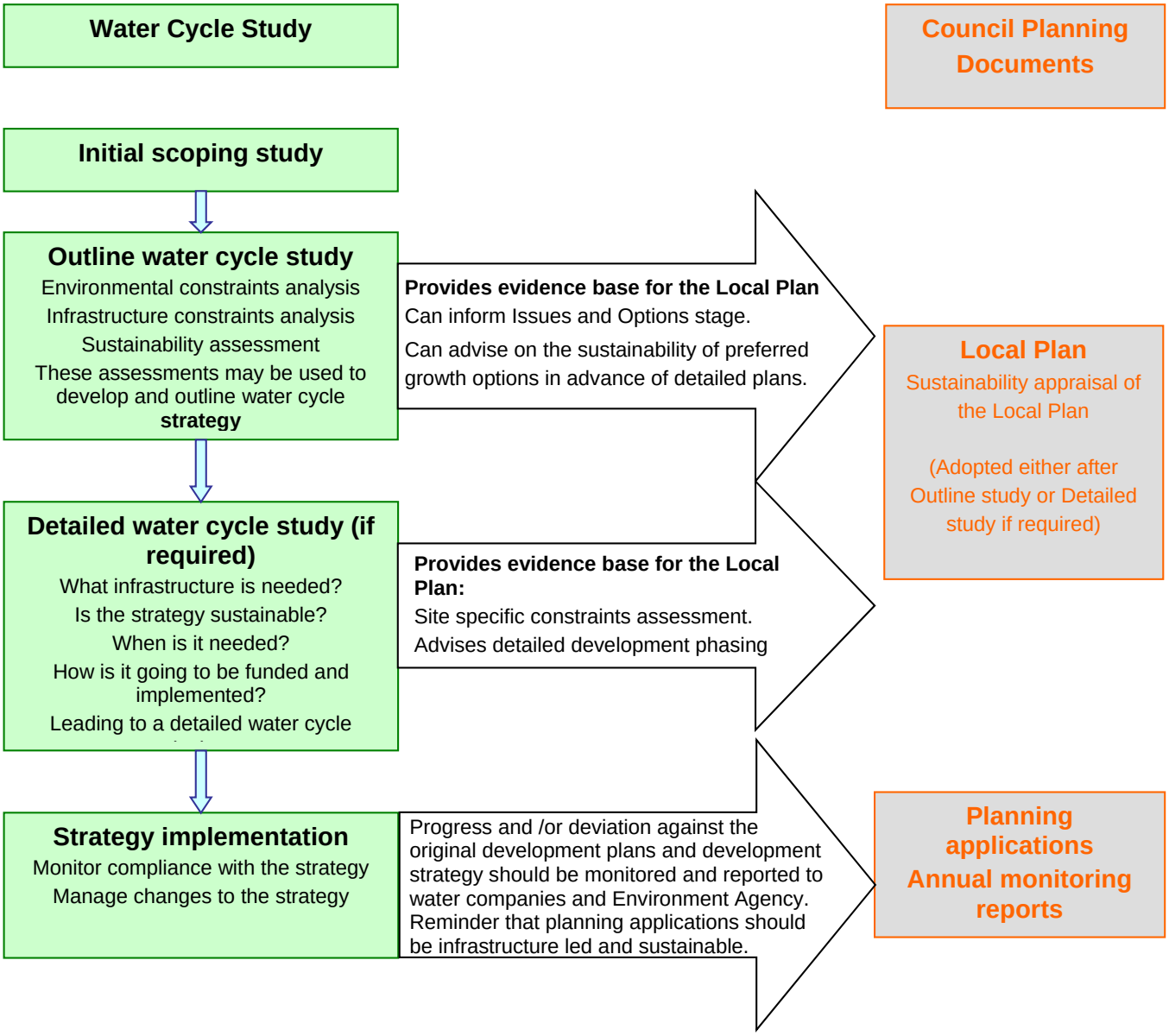
1.6 Local Plans and Water Cycle Studies

The need to examine existing water and environmental infrastructure in the South Downs National Park is driven by a requirement to align growth with infrastructure provision and so the context in which this study is undertaken is framed by:

- The scale and distribution of growth to be provided in the district;
- Relevant national and local planning policies; and
- The asset management plans of infrastructure providers.

Figure 1.1 summarises how the various stages of the water cycle study relate to the Local Plan process.

Figure 1.1 Planning context of water cycle studies



1.7 Scope and Approach

1.7.1 Study area

The South Downs is a range of rolling chalk hills and dry valleys that extends over 70 miles from the Itchen Valley (just east of Winchester) in Hampshire to Beachy Head (just west of Eastbourne) in East Sussex. The northern edge of the South Downs is marked by a steep north facing escarpment which overlooks the Weald.

The South Downs National Park forms a much larger area than the chalk range of the South Downs and includes part of the western Weald which is geologically and ecologically quite different. The undulating countryside of the Weald

in Hampshire and West Sussex is under lain by clay and the landscape includes a mixture of dense woodland and heathland areas.

The water environment in the area is influenced by rainfall, the underlying geology, and types of land use in the district. Long term rainfall data at Eastbourne (1959-2013) shows average rainfall in the area is 792mm per year[6]. A thick band of porous chalk underlies the South Downs. Water infiltrates quickly into the cavernous bedrock and flows quickly through the geology. There is a large chalk aquifer which provides much of the water supply in the local area and groundwater emerges as winterbournes along the northern escarpment.

Water flows quickly through the chalky area of the South Downs and the level of groundwater can increase rapidly in response to prolonged rainfall leading to groundwater flooding when the water reaches the surface. In contrast the clay / Greensand geology of the Western Weald does not support infiltration and in this area water attenuates and can accumulate on the surface.

The underlying aquifer provides baseflows for the chalk-rivers of the Itchen, Meon, and in part the Rother, although most of the Rother flow is supported by rainfall run-off through the Weald and baseflow from the Lower Greensand. Further east the Arun and Adur slice through the South Downs on their way to the English Channel whilst the sea pushes inland via the tidal reaches of the Ouse and Cuckmere in East Sussex. The majority of other valleys are dry, although some support winter streams or 'bournes' that flow as a result of seasonal raising of the water table.

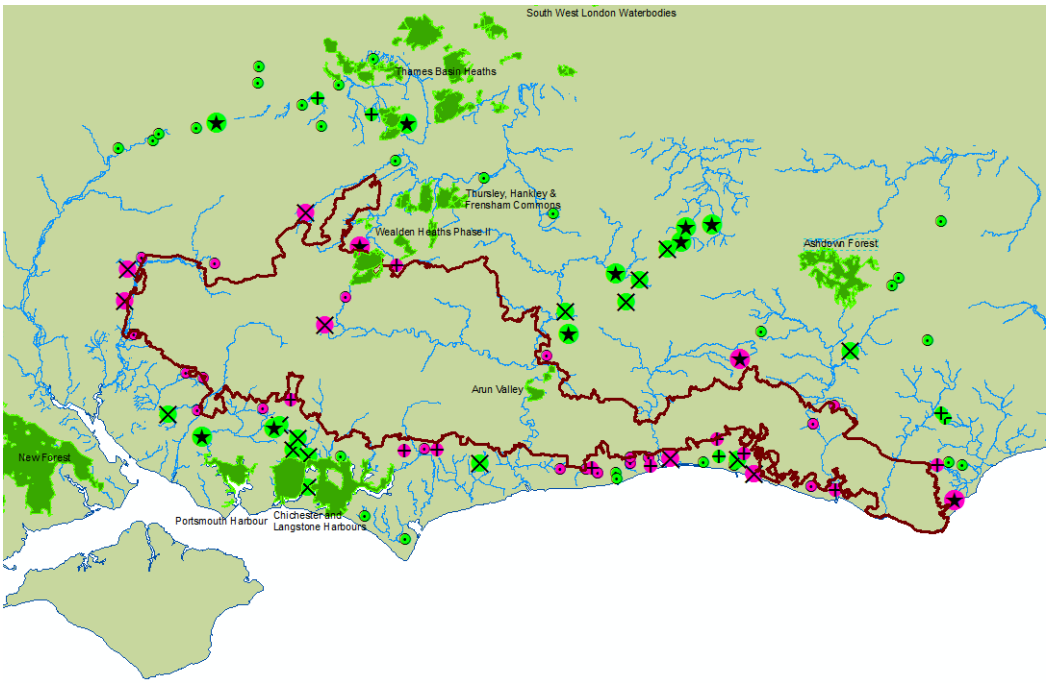
Inside the National Park there has been little development and settlements are mostly small villages although there are two main towns at Petersfield and Lewes. Roads and villages are concentrated along the river valleys, while the more elevated areas are sparsely settled with scattered farmsteads. The total population living within the National Park is around 108,000.

The National Park and its surrounding areas contain a large number of designated sites of European, national, and local importance. Figures 1.1 to 1.6 illustrate the various and numerous designated sites within the South Downs National Park and surrounding areas. Special Areas of Conservation (SACs) are designated under the Habitats Directive and the Special Protection Areas (SPAs) are designated under the Birds Directive. Both categories of site are strictly protected as part of the European wide Natura 2000 network. Ramsar sites are wetlands of international importance, designated under the Ramsar Convention. There is a Ramsar site located directly within the National Park and others located in the surrounding areas.

Figures 1.2 to 1.6 include plots of the proposed development sites (available at the Scoping Assessment) within and surrounding the study area. Site specific development data is not available at the Scoping Assessment stage but areas of development have been identified by the SDNPA. The pink circles represent potential development areas within a 2km distance of the SDNP area and the green circles are sites beyond this. The potential scale of housing development is indicated via comparative size of the symbols. More information on these development sites is provided in section 3.1. In this section the aim is to highlight the general spatial distribution of designated environmental sites and the potential relationship with new development sites.

[6] Analysis on data from http://www.metoffice.gov.uk/public/weather/climate-historic/#?tab=climateHistoric

Figure 1.2 Map of Special Protection Areas (SPAs) in and surrounding the South Downs National Park



*Sites outside of the National Park boundary are strategic sites within neighbouring local authority areas but being managed by the South Downs National Park Authority (section 1.2)

Figure 1.3 Map of Special Areas of Conservation (SACs) in and surrounding the South Downs National Park

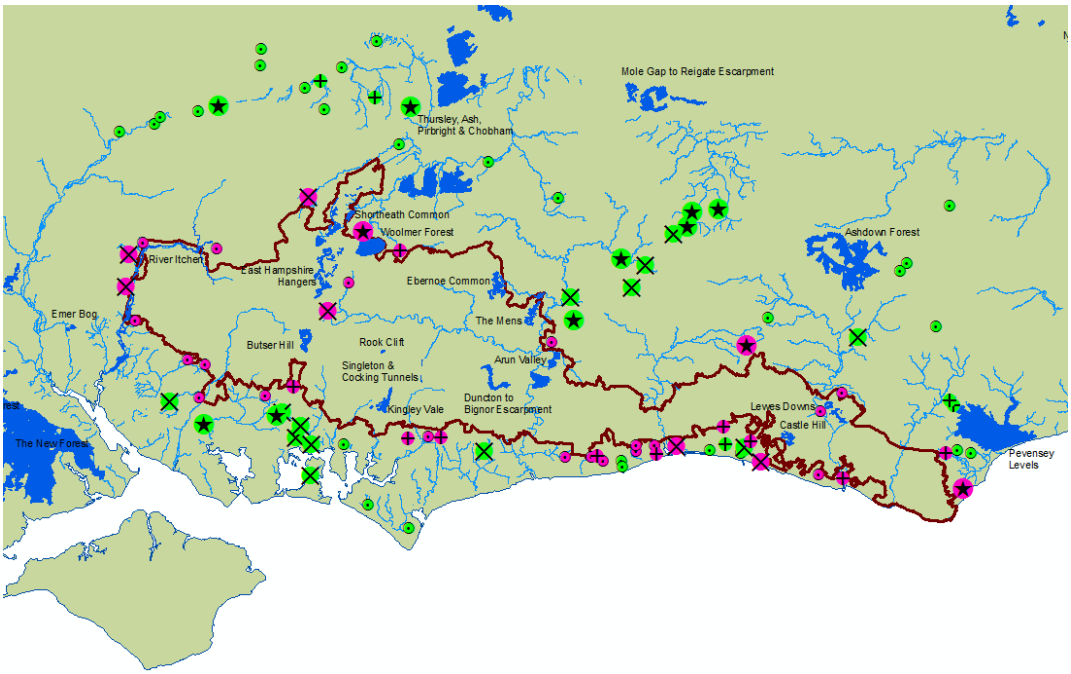
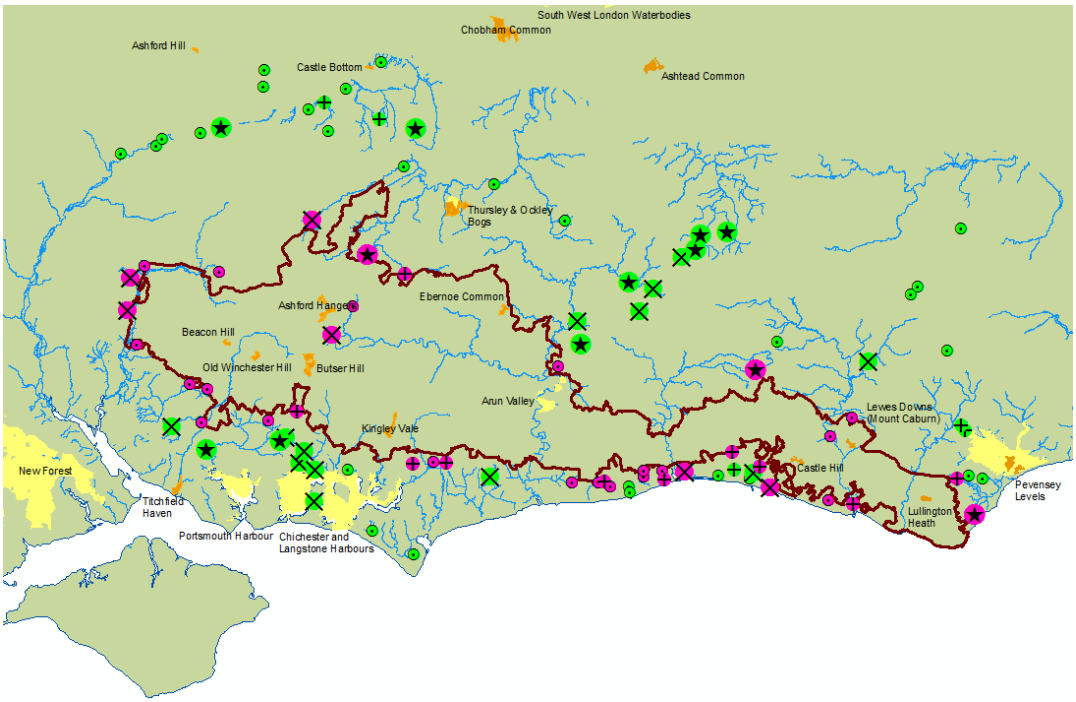
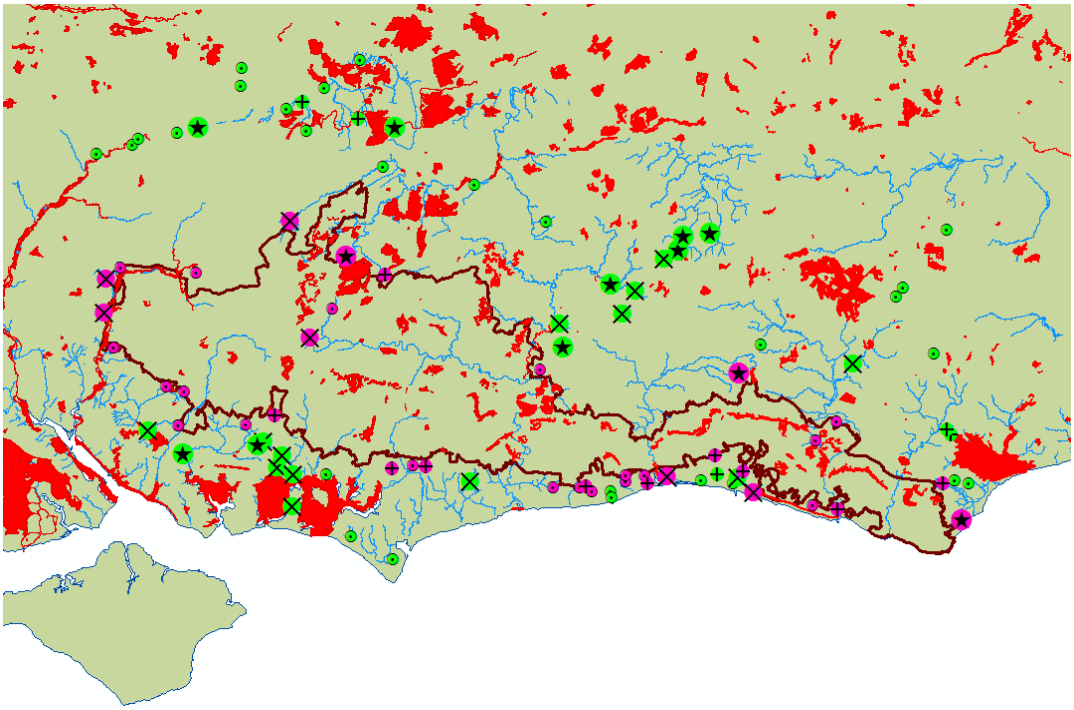


Figure 1.4 Map of Ramsar sites and National Nature Reserves in and surrounding the South Downs National Park



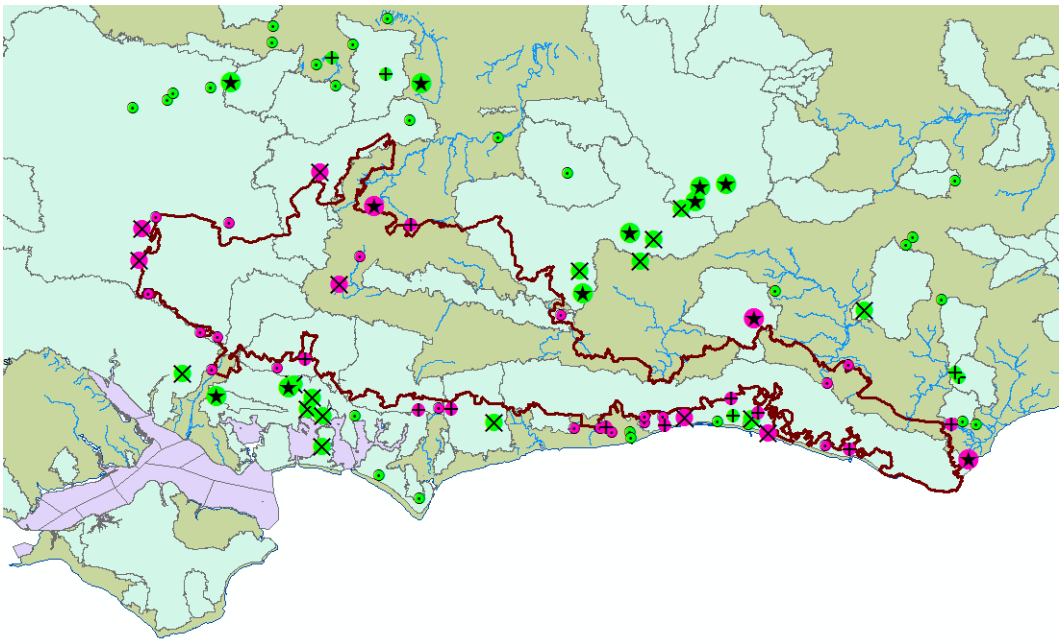
Key: Yellow: Ramsar sites; Orange: National Nature Reserves

Figure 1.5 Map of Sites of Special Scientific Interest (SSSI) in and surrounding the South Downs National Park



Key: red polygons indicate SSSI

Figure 1.6 Map of nitrate vulnerable zones (NVZs) and shellfish sensitive areas



Key: aqua polygons indicate nitrate vulnerability and purple polygons indicate shellfish sensitive areas.

1.7.2 Scope

The geographic remit of the SDNPA area of responsibility is defined by the National Park boundary although the Access Network and Accessible Natural Greenspace (ANG) study area included the full extent of all the intersecting local authorities and beyond into adjacent Local Authority areas. For the purpose of this study the SDNPA restricted the study area to the National Park itself and surrounding area within a distance of 2km of the park boundaries (to identify any issues arising from shared use of water services infrastructure or water environment). The study area also includes the wider 'spheres of influence', i.e. all nine water resource zones supplying the SDNPA and the water catchments (CAMS) in which public water supply abstractions are located. Wastewater treatment and sewerage services relevant to the study may also extend beyond the authority boundary. The scope of the Water Cycle Study does not include areas of the National Park where only very small scale development proposed.

A baseline flood risk characterisation precedes the level 1 SFRA. The baseline assessment considers the approximate site locations across the South Downs National Park and the relevant outputs from catchment and Local Authority level studies and data. The Level 1 SFRA is undertaken on the SHLAA data provided and provides site specific flood risk assessment without the more detailed site investigations and mitigation assessment that a Level 2 SFRA would contain. At this stage a Level 2 SFRA has not been commissioned. As the Water Cycle Study and the SFRA have been undertaken in parallel the SFRA has been incorporated into the Water Cycle Study. The results of the baseline assessment are incorporated into the Scoping Assessment and the SFRA informs the conclusions of the Outline Assessment. If required, more detailed site specific water and sewerage infrastructure constraints could be

examined within a Detailed Water Cycle Study . At this stage a Detailed Water Cycle Study has not been commissioned.

The development horizon applied to this study is the period 2014 to 2032 and only housing growth is under consideration. No information on commercial development has been provided for this study.

1.7.3 Involvement of stakeholders

A Steering Group was formed to generate support and ownership across the core organisations whose operational and planning activities directly interact with those of SDNPA, in terms of the development proposals. The Steering Group is composed of representatives of the core organisations with responsibility for development planning, water infrastructure services, and environmental regulation:

Steering group composition:

- Southern Water: Data and information on water resources and supply ; and wastewater and sewerage constraints and plans;
- South East Water: Data and information on water resources and supply;
- Portsmouth Water: Data and information on water resources and supply;

  The water companies have provided advice on the accuracy of the technical content relating to its infrastructure and approach to secure robust services to its existing and forecast customer base in the study area.

- Environment Agency: Overarching interest that the study makes adequate assessment of the various water resource, water quality, groundwater, and the range of flood risk issues in the area and that the most robust information is used to support this. Environment Agency also has responsibility for planning liaison, development control, and currently for management of the four Internal Drainage Board (IDB) areas: River Arun, River Adur, River Ouse, and the Cuckmere River although there are plans for the EA to relinquish responsibility for these by 2016.
- Hampshire County Council: Lead Local Flood Authority (LLFA) responsible for a range of tasks required to prepare and maintain a strategy for local flood risk management in Hampshire. Provided information and data on flood risk details specific to Hampshire;
- East Sussex County Council: LLFA;
- West Sussex County Council: LLFA;
- Brighton & Hove City Council: LLFA;

A Stakeholder Assessment was undertaken and discussion with the Steering Group concluded to notify the following

organisations about the WCS/SFRA being undertaken as an evidence base to support the Local Plan, and where relevant work with them to collate evidence to support the assessments:

- Thames Water: A very small part of the study area is served by Thames Water and so the company is involved providing data and information regarding wastewater treatment and sewerage;
- District Councils: Large-scale strategic development in the part of their District that falls within the National Park boundary is now the responsibility of the SDNPA. Awareness of the planning assumptions and constraints assessments remain of concern to the Councils who are also interested in wider scale issues that could be relevant to smaller scale developments for which they remain responsible;
- Natural England: Concern that development plans recognise and take into consideration the requirements of designated sites;
- Wildlife Trusts (Hampshire & Isle of Wight, Sussex): Concern about the potential impact of large scale development on nature reserves and other sites important to the Wildlife Trusts;
- National Parks Commission: Interest in the approach taken by the new South Downs NPA to integrate development planning with water environment and infrastructure constraints and plans;
- The Catchment Partnerships (including the Rivers Trusts) – via the Catchment co-ordinators in the Environment Agency: Valuable insights available from the Partnerships' particularly relating to the causes of flood risk and mitigation options;
- Selected landowners (private abstractors): Concern over the risks of construction activity on private water sources, and the risks that demand for water to supply additional development could have on private supplies;
- Parish Councils: Concern over the location of potential large-scale development sites within their areas;
- CPRE: Concern about the impact of housing development in rural areas, and;
- South Downs Society: Concern about the impact of housing development in the National Park.

The stakeholder assessment also identified developers as a stakeholder group that ultimately will be interested in the study particularly if the constraints assessments and water infrastructure plans affect decisions on the acceptability or timing of development sites to proceed. At this stage the development plans are not yet advanced to the point where specific developers have a recognised interest in specific sites.

1.7.4 Consultation

Implementation of the South Downs Local Plan will affect local people and businesses and, as an important document consultation is core to its development. The SDNPA has a consultation programme to ensure all stakeholders in the

area are able to contribute to the plan. However, it is unfeasible to consult on every individual component of the evidence base. Whilst the steering group has been consulted on the technical content of this study and the Water Cycle Study may be made publicly available, it has been decided not to actively consult more widely on that technical content primarily because the vast majority of information used in the study is taken from data and plans provided by third parties which have already been subject to consultation on their own merits. Section 6.4 of this report sets out recommendations for the South Downs National Park Authority to ensure that development in this area is sensitive to the local constraints and follows sustainability principles. Any further policy development, e.g. if water efficiency standards that deviate from national standards are to be implemented locally, this would be subject to consultation when the Local Plan is developed. Table 1.1 summarises the core sources of information used in this study which have been subject to consultation. A full list of data sources used is available in Appendix A.

Table 1.1 Aspects of the study and underpinning consultations

Aspect of study	Data source	Consultation on the data source
Potential development (locations, property type, numbers)	Access and Available Natural Greenspace study (ANG) as updated by Individual Local Authority planning data and the 2014 SDNPA SHLAA data.	Local plans subject to consultation and Examination in Public. Consultation draft released in January 2014.
Biodiversity and designated sites	MAGIC: authoritative geographic information about the natural environment from across government. The information covers rural, urban, coastal and marine environments across Great Britain. Access and Available Natural Greenspace study (ANG).	Government data publicly available.
Water resources and supply	Water company 2014 Water Resource Management Plans (WRMPs). Catchment Abstraction Management Plans.	Public consultation on the draft WRMPs (2013-14). Published for consultation by the Environment Agency.
Wastewater treatment capacity	Water Framework Directive (South East River Basin Management Plan [7]). Southen Water technical assessment. Thames Water technical assessment. Water Quality and Strategic Growth for Chichester District background paper (November 2012) [8]TW assessment.	Main report and 14 annexes available online. Available online. Not publicly available. Not publicly available. Part of Chichester District Council's Planning Policy supporting documents (online).
Sewerage	Southern Water assessment (DG5 database). Thames Water assessment (DG5 database).	Not publicly available. Not publicly available.
Flood risk	Seven Catchment Flood Management Plans (CFMPs). Ten District level Strategic Flood Risk Assessments (SFRAs). Two Shoreline Management Plans (SMPs). Four Preliminary Flood Risk Assessments (PFRAs). Brighton & Hove, and Lewes Surface Water Management Plans (SWMPs).	Published for consultation by the Environment Agency. Published for consultation by the individual councils. Published for consultation by the Environment Agency. Published for consultation by the individual councils. Published for consultation by the Environment Agency.

[7] https://www.gov.uk/government/publications/south-east-river-basin-management-plan
[8] http://www.chichester.gov.uk/index.cfm?articleid=22456

Aspect of study	Data source	Consultation on the data source
	Brighton & Hove, and Lewes Integrated Urban Drainage Pilot Studies.	Published for consultation by Defra.
	Lower Tidal River Arun Draft Flood Risk Management Strategy.	Published for consultation by the Environment Agency.
	Tidal Strategies for the Rivers Arun, Adur, and Cuckmere Haven.	Published for consultation by the Environment Agency.

2. The Water Cycle

2.1 Introduction

This report refers to specific elements of the water cycle and processes by which they connect to each other and the water cycle and so in advance of presenting the outcomes of the Scoping Assessment and Outline Assessment this section gives an overview of the water cycle.

The water cycle describes the pathways and processes through which the water we use moves through the natural and built environment, as well as through the above and below ground infrastructure on which the domestic population and industry depend. Figure 2.1 illustrates the traditional image of the water cycle showing how water enters a river catchment, how it runs through and over the land, before returning to the river system and ultimately returning to the sea.

Figure 2.1 Traditional view of the water cycle without artificial influence

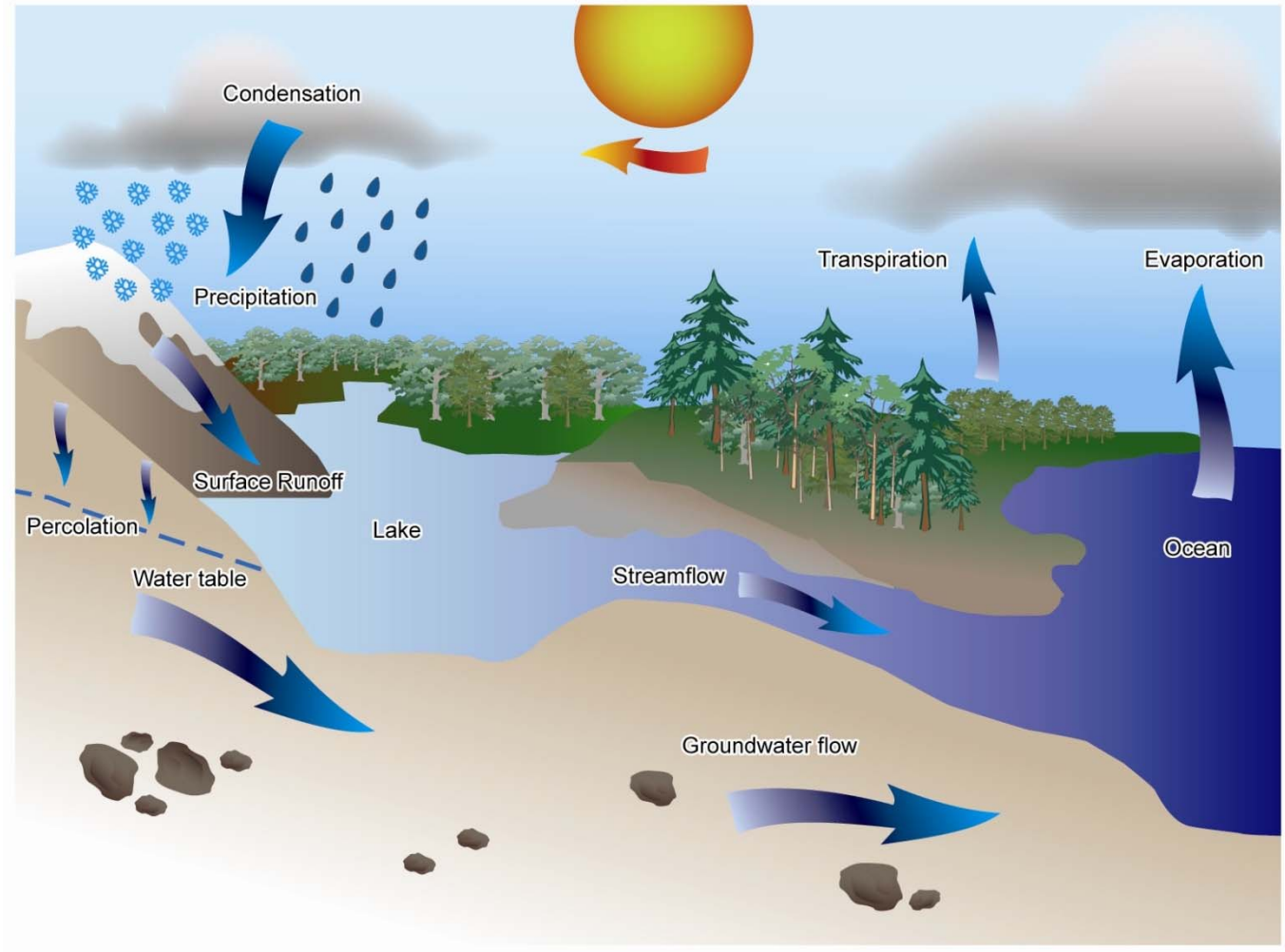
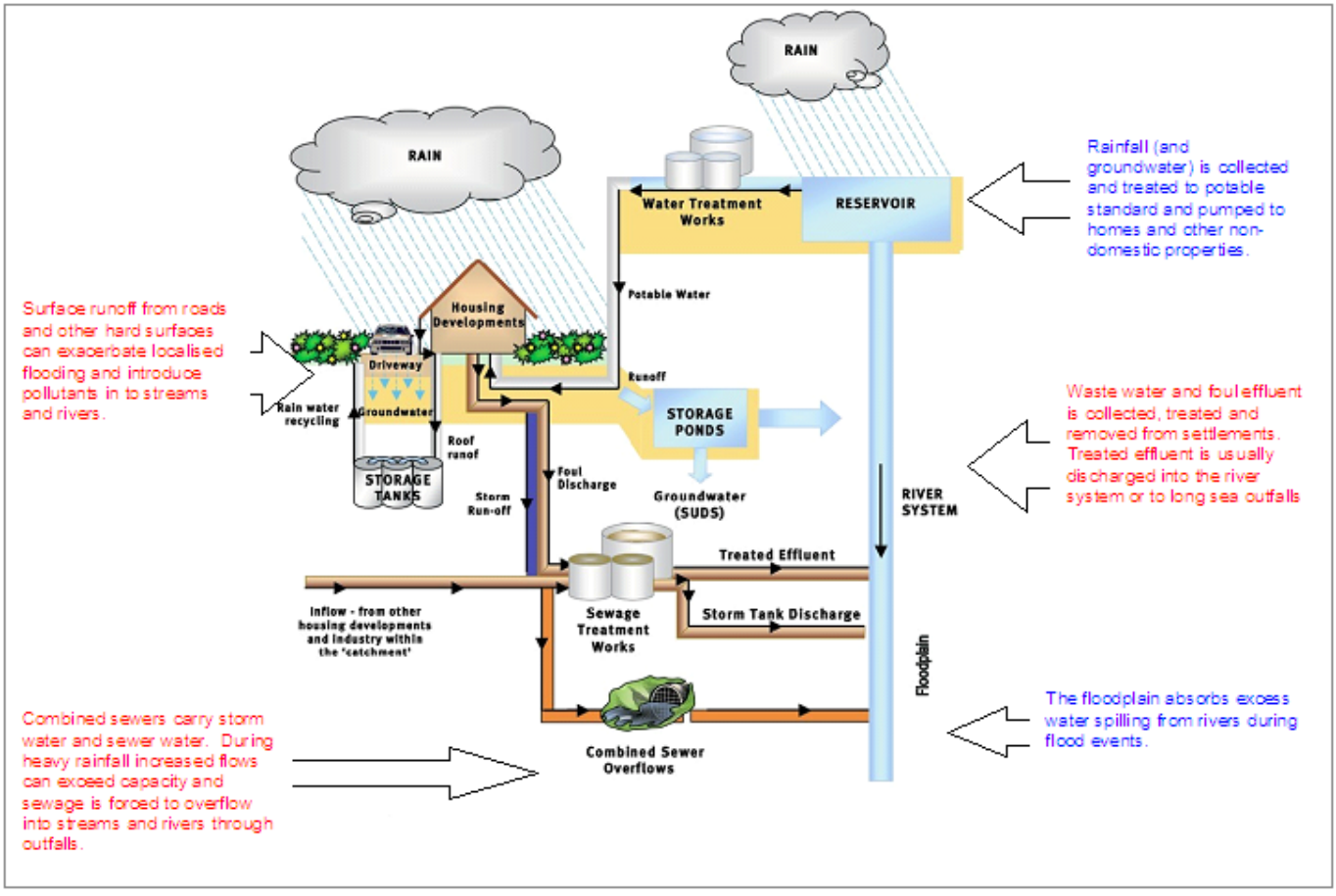


Figure 2.2 illustrates the added complexities within the urban water cycle (in schematic form) as a result of housing development and the infrastructure required to support it. The main differences between the natural and the urbanised water cycle relate to the rate of surface runoff (and infiltration) and overland stream flow. In the urbanised cycle water is captured and stored for use, and this water only re-enters the river network once it has been used and then treated at wastewater treatment works. Hence, the timing and quality of water entering the river network can be significantly different in the urban version of the cycle.

Figure 2.2 Schematic of the urban water cycle based on current practice



The capacity of the water infrastructure needs to be sized appropriately to ensure the sufficient supply of clean water to homes and industry and to receive foul drainage, whilst preventing the discharge of polluted runoff and untreated foul drainage to protect the quality of the receiving water and any dependant habitats, whilst also reducing the risk of flooding.

2.2 Integrated Catchment Management

Integrated Catchment Management is an approach that is designed to identify various catchment issues and meet environmental objectives by considering the various land uses and catchment processes as components within an integrated system, and by examining issues, not in isolation but as a product of all activity within the catchment.

Environmental objectives take many forms but the most relevant in terms of this water cycle study and SFRA are the river water quality objectives including the impact of low and high flows. Understanding how water moves through a catchment is fundamental to managing low flows, increasing resilience to flood risks, and improving water quality.

It is important to understand the different scales at which the elements of the water cycle (water supply, sewerage and drainage) are managed, and the impacts this has on assessing constraints to growth. Water supply is managed strategically, as there is a high level of connectivity in the water supply network and water can be moved great distances from the raw water sources (rivers, reservoirs, or groundwater) to the point of delivery. Generally, new developments can be connected to the main system relatively easily. In contrast, wastewater treatment works have much smaller defined catchment areas and so the location of development relative to the capacity of the nearest treatment works and receiving water can be critical. Although drainage issues are specific to individual developments, the integration of drainage development across sites offers significant potential for green space/habitat creation, in addition to reducing flood risk and potentially water demand.

South Downs National Park Authority works with the Environment Agency and Southern Water in the Downs & Harbours Clean Water Partnership to identify and address nitrate pollution of the chalk aquifers.

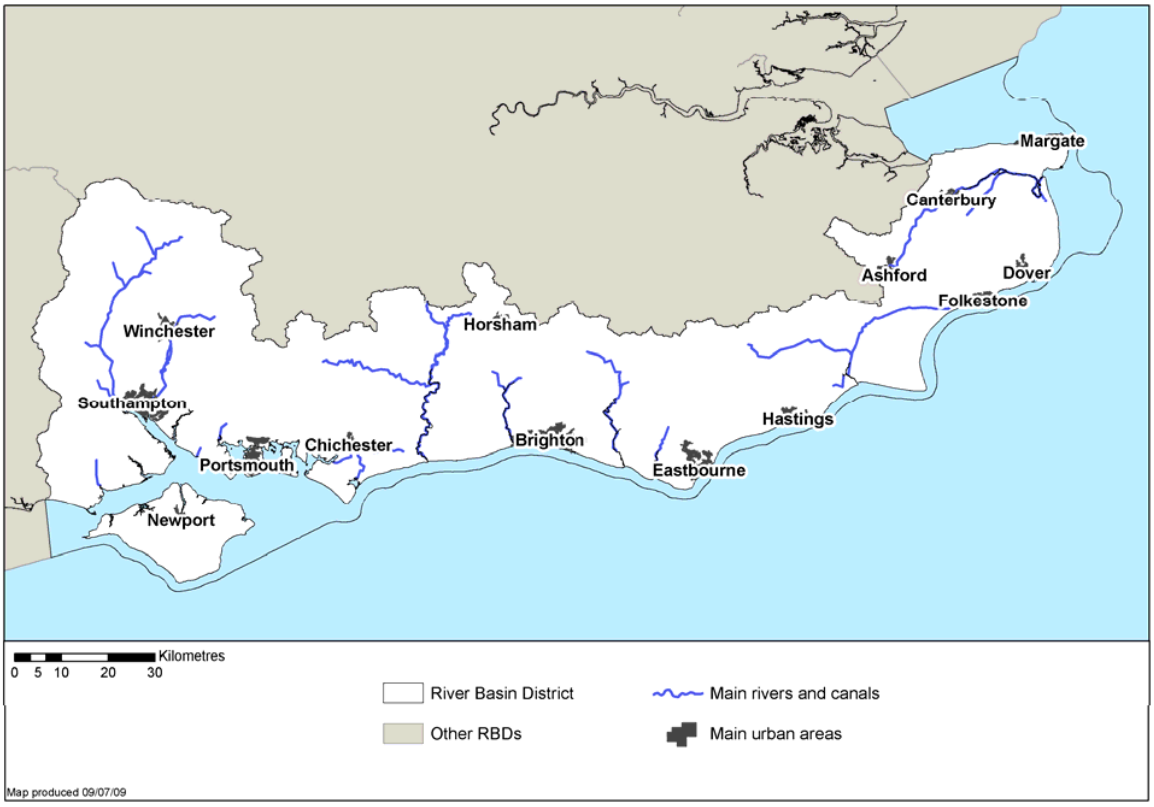
2.2.1 Water quality objectives

The capacity of the receiving water environment, and thus development in the study area, is constrained by environmental quality objectives enforced by UK and European legislation. The Water Framework Directive (WFD) is European legislation that aims to consolidate existing legislation. It came into force in December 2000, and was transposed into UK law in 2003. It introduces new environmental standards that will help to improve the ecological health of inland waters to achieve 'Good Status'. Delivery of the WFD is managed at a 'River Basin' scale. There are eleven river basins covering England and Wales. The South Downs National Park is within the South East River Basin District (Figure 2.3).

The main aims of the WFD are to prevent deterioration and enhance the status of the water environment, including groundwater. This will be achieved within a framework of River Basin Planning by:

- Reducing pollution;
- Promoting sustainable water use; and
- Contributing to mitigating the effects of floods and droughts.

Figure 2.3 The Water Framework Directive South East River Basin



This Scoping Assessment examines the existing and target WFD water quality objectives of the water receiving treated wastewater effluent and explores the parameters contributing to the quality assessments (section 3.5.2) whilst the Outline Assessment focuses on the relationship between these issues and the potential growth plans in the South Downs. This is specifically the impact of increased demand for wastewater treatment on activity at the treatment works and pressure on the receiving waters. Water quality issues often have multiple contributing factors and these are mentioned for reference, although where not directly related to housing growth in the local area, these are not examined in detail.

As well as discharges from treatment works the way that water moves through a catchment has significant impacts on water quality and the appearance of water bodies. Imposition of the urban water cycle (Figure 2.2) upon the natural environment alters the routes that water takes to move through the catchment, the quality of the water, and the speed with which it moves. The volume and speed of surface water run-off, and the nature of the land over which it runs, affects rates of diffuse pollution, from farmland and urban surfaces.

Traditionally piped drainage was designed to convey rainfall away from developments as quickly as possible; however this can lead to water entering rivers more quickly in urban areas compared to rural catchments and can result in flooding. Sustainable drainage systems (SuDS) is the name given to drainage techniques that aim to mimic

natural processes, rather than using traditional piped urban systems. Sustainable drainage systems use grassed ditches and ponds, for example, instead of pipes to control rainfall. These allow some rainfall to soak back into the ground, and this slows down the movement of rainfall runoff in the catchment. Vegetation in these systems can also reduce the amount of urban pollutants entering watercourses and groundwater sources. The applicability of SuDS varies spatially, primarily due to local geology. The feasibility of SuDS in relation to the South Downs is discussed in Chapter 5 (section 5.4.1).

Pressure on water infrastructure and the water environment can also be reduced by reducing the volume of water used in homes and other buildings. In the UK, all water that is supplied to properties and business is treated to a standard suitable for drinking.

Water efficiency measures help to reduce the volume of water abstracted from rivers and groundwater sources, reducing the pressure on natural ecosystems and increasing the volume of water available for diluting both point source and diffuse pollution. Installing devices that reduce water use also reduces pressure on the sewerage network (notwithstanding blockages) and reduces the volume of wastewater that has to be treated at and then discharged from wastewater treatment works.

The urban water cycle is complex and highly integrated with many feedback mechanisms. Advanced planning and appropriate management helps to ensure that the water cycle contributes to a safe, clean and healthy environment, rather than being a source of long term problems.

2.3 Legislation and Guidance

Legislation, guidance and supporting evidence for water related issues, such as water quality, flood risk management and urban drainage, have a significant impact on the water cycle and are often the cause of changes in water infrastructure, as much as development pressures. Any adaptations to the water cycle must be compliant with such legislation and some are undertaken within the regulatory framework.

There is currently a significant level of change in the legislation and guidance for water related issues. Some of these changes are driven by European directives; others are in response to national pressures, from the 2007 summer floods for instance. These changes are either currently being implemented, soon to be applied or likely to change in next five to ten years. The timetable for the Water Framework Directive spans another 13 years until 2027[9]. The first management cycle finishes in 2015 by which time the water companies and the Environment Agency expect to have carried out the majority of investigations to establish the necessary investment and achieve the WFD targets for many waterbodies. This cycle provides an opportunity to assess the improvements delivered through other quality investments. During the second management cycle (2015-2021) the River Basin Management Plans will be reviewed and action plans to improve water quality and 'Ecological Status' of more problematic waterbodies will continue to be implemented. The final cycle will take place between 2021 and 2027 at the end of which all waterbodies are expected to achieve 'Good Ecological Status'.

[9] http://ec.europa.eu/environment/water/water-framework/info/timetable_en.htm

The primary pieces of legislation which set the context relating to the water cycle are summarised in Table 2.1.

Table 2.1 Primary water related legislation

Legislation	Description
Water Framework Directive	The Water Framework Directive sets out a requirement to achieve Good Ecological Status in rivers, estuaries and coastal waters, together with Good Status of groundwater by at least 2027. It presents a unique opportunity for holistic environmental management for all users of the water environment. A cross-body Technical Advisory Group (UKTAG) has published environmental standards and thresholds. Whilst there is no certainty that these standards will become statutory in the current form, they form the best current knowledge of how the standards may change.
Habitats Directive	As people make increasing demands on the environment, wildlife habitats are coming under more and more pressure. The Habitats Directive recognises this and aims to protect the wild plants, animals, and habitats that make up our diverse natural environment. The European Directives created a network of protected areas of national and international importance. These are called 'Natura 2000' sites and include Habitats Directive Special Areas of Conservation (SACs). The Habitats Directive has been transposed into English law as the Conservation (Natural Habitats &c) Regulations 1994, now known as the Habitats Regulations. Existing and future water management has the potential to affect a number of these designations and the Environment Agency Review of Consents process has identified a series of amendments that will be required to existing abstraction licences and discharge consents if adverse effects on the European Sites are to be avoided.
Urban Wastewater Treatment Directive	The Urban Wastewater Treatment Directive (UWWTD) regulates the collection and treatment of wastewater from residential properties and industry. Under this Directive receiving waters can be designated as 'Sensitive' where additional levels of treatment are required at significant contributing discharges. These can either be direct discharges or those upstream of the designated reach / water body that serve a population equivalent in excess of 10,000. One type of sensitive area is the "Sensitive Area [Eutrophic]", where elevated nutrient concentrations, mainly nitrogen or phosphorus, present a risk to the ecological status of the receiving water. In these areas, larger sewage discharges must be treated to reduce nutrient loads.
Nitrates Directive	Adopted by the European Union in 1991, this directive aims to reduce water pollution caused by nitrogen from agricultural sources and to prevent such pollution occurring in the future. The directive requires Defra and the Welsh Assembly Government to identify surface or groundwaters that are, or could be high in nitrate from agricultural sources. Nitrogen is one of the nutrients that can effect plant growth. Surface waters also have to be identified if too much nitrogen has caused a change in plant growth which affects existing plants and animals and the use of the water. Once a water body has been identified, all land draining to that water is designated as a Nitrate Vulnerable Zone. Within these zones, farmers must observe an action programme of measures which include restricting the timing and application of fertilisers and manure, and keeping accurate records.
Freshwater Fish Directive	The EC Directive on Freshwater Fish is designed to protect and improve the quality of rivers and lakes to encourage healthy fish populations. It sets water quality standards and monitoring requirements for areas of water which are chosen, or 'designated' by Defra. These 'designated' areas of water are selected because they are significant bodies of water which are capable of supporting fish populations.
Floods Directive and Flood Risk Regulations 2009	The Floods Directive is designed to help Member States prevent and limit floods and their damaging effects on human health, the environment, infrastructure and property. The Floods Directive came into force on 26 November, 2007. The Directive requires Member States to first carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015. The Directive applies to inland waters as well as all coastal waters across the whole territory of the EU. The Flood Risk Regulations 2009 was published in December 2009 to transpose the directive into UK law
Floods and Water Management Act	The Flood and Water Management Act received Royal Assent on 8 April 2010. It is designed to improve how the UK prepares for and responds to flood emergencies and better protect water quality and water supplies during drought. The Act will provide better, more comprehensive management of flood risk for people, homes and businesses. It will also help tackle bad debt in the water industry, improve the affordability of water bills for certain groups and individuals, and help ensure continuity of water supplies to the consumer. Implementation of the first parts of the Flood and Water Management Act 2010 begins on the 01 October 2010.

Legislation	Description
Water Act 2003	The Water Act 2003 made significant changes to the water abstraction licensing system and water resource planning processes. It adopted a risk based approach and deregulated small abstractions (<20m^3/day), introduced all irrigation abstractions into the licensing system and introduced time limited licensing. It also made it a statutory requirement for all water companies to prepare and publicise drought plans and Water Resource Management Plans (which had until that point been voluntary).
Water Act 2014	The Water Act 2014 received Royal Assent on 14 May 2014. The purpose of this Act is to reform the water industry particularly introducing legislation to support competition in water supplies, enabling water trading, and reforming drought management requirements. It also introduces measures to restore the sustainable abstraction of water, to streamline the environmental permitting framework, and to encourage the use of Sustainable Drainage Systems (SuDS).

3. Water Cycle Scoping Assessment

3.1 Development data

For the Scoping Assessment SDNPA collated data from the individual Local Authorities' development proposals during the spring / summer period in 2013. The Districts and Boroughs are at different stages developing their Local Development Framework/Local Plans and very few have approved joint core strategies[10]. Accordingly, collated data is likely to be slightly different to detail in locally specific plans as they are updated. The data used to assess the general situation across the study in the Scoping Assessment was provided as a GIS layer by SDNPA. 38 potential site locations and indicative (maximum) levels of housing growth are listed in Table 3.1 and illustrated in Figure 3.1. It was agreed for this study to examine the water cycle and flood risks in the context of the large scale strategic sites within a 2km distance of the perimeter of the National Park area. These sites are shown as pink circles on Figure 3.1. Large scale strategic developments beyond the 2km distance are out of the scope of this study and are shown as green circles. These sites are potential allocated sites, provided to the study by the SDNPA from local authority data. Third parties with queries regarding the location and statusof these potential development sites are advised to contact the relevant Local Authority.

Table 3.1 Large-scale potential strategic development sites within the study area

Site code	Local Authority District	Site name*	Potential range of development units	Estimated actual number of development units
A01	Arun	Angmering	100 - 500	490
A02	Adur	New Monks Farm, East Lansing	100 - 500	500
A03	Adur	Sompting Fringe, Lansing	100 - 500	250-500
A04	Adur	Sompting North	100 - 500	210
A05	Lewes	Peacehaven	100 - 500	220
A06	Lewes	Lewes	100 - 500	350
A07	Lewes	Ringmer	100 - 500	120
A08	Horsham	Pulborough expansion	100 - 500	280
A09	Winchester	Bishops Waltham	100 - 500	500
A10	Winchester	New Alresford	100 - 500	500
A11	Winchester	Colden Common	100 - 500	250
A12	Winchester	Denmead	100 - 500	250
A13	Winchester	Kings Worthy	100 - 500	250
A14	Winchester	Swanmore	100 - 500	250

[10] Access and Network Greenspace Study, Appendix (January 2014).

Site code	Local Authority District	Site name*	Potential range of development units	Estimated actual number of development units
A15	Winchester	Wickham	100 - 500	250
A16	Chichester	Westhampnett	100 - 500	500
A17	East Hampshire	Liss	100	150
A18	Worthing	Northbrook College	100 - 500	105
A19	Worthing	Worthing College	100 - 500	124
B01	Adur	Hasler	500 - 1000	300-600
B02	Brighton & Hove	Lewes Rd	500 - 1000	810
B03	Brighton & Hove	Toads Hall Valley	500 - 1000	700
B04	Lewes	Newhaven	500 - 1000	780
B05	Wealden	Land south of Polegate and East of Willingdon	500 - 1000	700
B06	Chichester	Tangmere	500 - 1000	1000
B07	Chichester	West Chichester	500 - 1000	1000
B08	East Hampshire	Liphook	500 - 1000	175
B09	East Hampshire	Horndean	500 - 1000	700
B10	Worthing	Durrington	500 - 1000	700
C01	Adur	Shoreham Harbour	1000 - 3000	1050
C02	Brighton & Hove	Brighton Marina	1000 - 3000	1940
C03	Winchester	Barton Farm	1000 - 3000	2000
C04	Winchester	City	1000 - 3000	2000
C05	East Hampshire	Petersfield	1000 - 3000	700
C06	East Hampshire	Alton	1000 - 3000	1000
D01	Mid Sussex	Burgess Hill 1 & 2	>3000	3980
D02	Eastbourne	Town centre & neighbourhoods	>3000	2440
D03	East Hampshire	Bordon and Whitehill Ecotown	>3000	4000 max (2700+ in early period)

*According to Local Plan develop data collated and published in the ANG, 2014.

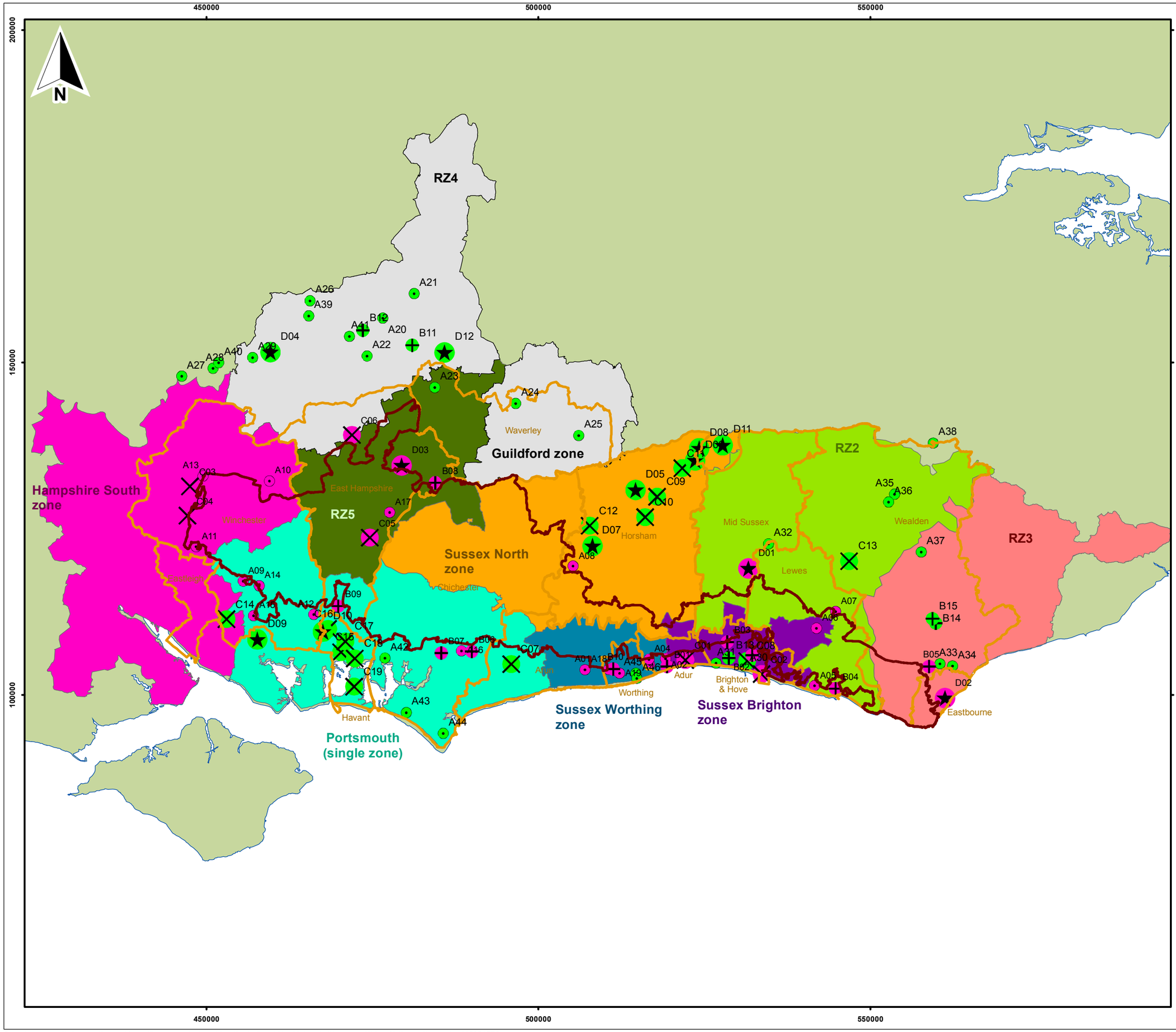
In order to represent the max potential growth visually four growth categories are disaggregated:


100 – 500 new homes


500 – 1000 new homes


1000 – 3000 new homes


More than 3000 new homes



Key:

- South Downs NPA
- Local Authorities

Water resource zones:

Southern Water:
- Hampshire South
- Sussex North
- Sussex Worthing
- Sussex Brighton

Portsmouth Water:
- Portsmouth

South East Water:
- RZ5
- RZ2
- RZ3
- RZ4

Thames Water:
- Guildford

Potential strategic development sites (within study area)
- 100 - 500 new homes
- 500 - 1000 new homes
- 1000 - 3000 new homes
- 3000+ new homes

Potential strategic development sites (beyond study area)
- 100 - 500 new homes
- 500 - 1000 new homes
- 1000 - 3000 new homes
- 3000+ new homes

0 5 10 20 Kilometers

H:\Projects\35227 South Downs Water Cycle Study\Drawings

South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 3.1
Potential strategic development sites

June 2014
35227-Bri13.mxd ryans

amec

The maximum growth potential offered by all of these sites in combination (~47,000) is far in excess of the actual projected growth plan (250 per year until 2032, 4500 new homes). Actual growth is likely to be concentrated in a small proportion of these sites and potentially at lower levels than the maximum capacities indicated. The Scoping Assessment uses the full range of potential sites to flag up the different types of issues, or combinations of issues that could constrain development. Maximum development at sites represents the 'worst case' scenario from water infrastructure and flood risk perspectives. The Scoping Assessment presents the results of 'worst case constraints' together with indications of how much development could be accommodated within existing environmental and infrastructure headroom.

The implications of growth on the water environment and water infrastructure do not consider the South Downs data in isolation. The water resource assessment is based on a much wider area and the Outline Assessment examines the composition of the demand forecast to confirm the amount of growth that has been taken into account by the water companies. Wastewater treatment operates at the much smaller scale of wastewater treatment catchment area, which can range from a small village to multiple large towns. The assessments present the constraints in terms of available capacity and highlight the risks from competing growth in neighbouring districts where catchments extend across administrative boundaries. The SFRA is applied across the entire study area and includes recognition of the implications of additional development on future flood risk.

3.2 Water resources and water supply

Water resources in the South East of England are under pressure from increasing demand, environmental requirements, and the impacts of climate change on rainfall volumes and patterns. The Environment Agency's classification of water stressed areas indicates that the water supply areas in relation to the South Downs are under serious water stress [11] and therefore assessment of the water resource situation is an important part of this study. This Scoping Assessment briefly explains the Water Stress situation and what this means for water supplies and development planning in the South Downs.

This section of the report confirms which companies provide water supplies to homes in the study area and examines the water resource / supply context for new development plans. The most up to date available information is used to compare the volume of resource that is available to the water companies against the demand (the supply-demand balance) and how this is forecast to change over the next25 years. The situation varies across the SDNP area because three different water companies provide supplies in the region. Each company has access to different resources and their sources are subject to unique environmental flow requirements which affect how much they can abstract. The water companies are encouraged to and do work together to share water resources where possible and in the South Downs area there are a number of bulk water supply arrangements between the companies. For the purpose of planning development the information that is required to determine the sustainability of development proposals from a water resource perspective are:

1. What is the current situation in terms of demand compared to supply and how is that forecast to change over time?

[11] Environment Agency (2013) Water stressed areas – final classification

2. The water companies forecast demand and supply to identify what sort of water resource issues they may have to manage. The water companies are required by the Government to produce and consult on a water resource management plan (WRMP) every five years showing how they plan to manage water supply and demand over a 25 year planning horizon. This is a statutory requirement and in 2014 the companies are being advised by the Government if their WRMPs covering the planning period 2015 – 2040 have been approved. The Outline Assessment examines whether those forecasts include the growth plans included in this study.

3. When a forecast demand exceeds a forecast supply this is referred to as 'deficit' and the water companies have a responsibility to identify sustainable and cost-efficient solutions to resolve deficits. If deficits are forecast in the zones supplying water to the South Downs then the study examines the companies' options to resolve those deficits. The purpose of this study is not to critique the water companies' plans but present the water resource context in which development will take place. The Scoping Assessment confirms the status of the water supply-demand forecasts taking into account the solutions proposed by the companies. The Outline Assessment includes more information on the options that have been proposed to secure water resources in this region including the wider water resource factors constraining supply options, and the opportunities for planners to support demand management options through the development process.

4. In recognition of the water stress situation in the region the SDNPA is interested in a concept to deliver water neutral (WN) development in the park. There are many different interpretations of water neutrality and the water companies are likely to have considered the most appropriate techniques to manage demand in their areas within their latest plans. This Scoping Assessment examines some of the key aspects of this for more detailed consideration in the Outline Assessment.

Once the volume of water that is required to supply demand is secured (including by managing demand), the other supply task is to provide capacity within the supply network to distribute clean water. Potential problems include:

1. Sites identified for large-scale strategic development (which are the focus of this study) may not necessarily be in close proximity to the existing water supply network. Additional planning and pipeline installations may be needed to connect the sites to the mains supply which could generate delays. The Scoping Assessment reports the outcome of the initial discussions with the supply companies. Issues arising are examined further in the Outline Assessment including discussion on the funding implications for any specific development sites requiring significant infrastructure investment;

2. The water industry is undergoing reform and the Water Act 2014 (received Royal Assent on 14 May 2014) enables all business, charity, and public sector customers in England to switch their water and sewerage supplier[12]. Water supply services are now open to competition and this can have implications on the provision of services to new large sites. Portsmouth Water confirms within its 2014 WRMP that it "*already has two housing developments where a third party delivers the water to the end user. In these cases, Portsmouth Water is retained as the bulk supplier and there is no net increase in supply. It would be possible*

[12] https://www.gov.uk/government/policies/reforming-the-water-industry-to-increase-competition-and-protect-the-environment/supporting-pages/reform-of-the-water-market-the-new-water-bill

for a developer to install effluent re-use and therefore create a nominal surplus for Portsmouth Water to use elsewhere."

3.2.1 Water providers

Three water companies provide water supplies to the South Downs area: Portsmouth Water, Southern Water, and South East Water. Water company supply areas are sub-divided into water resource zones and it is at that level that they manage their resources and demands. A water resource zone is the largest possible zone in which all water resources, including external transfers, can be shared or distributed across the area. Hence within a water resource zone all customers will experience the same level of service, and the same risk of supply failure from a resource shortfall.

Portsmouth Water operates a single company sized zone, but the study area is intersected by four Southern Water zones (Hampshire South, Sussex North, Sussex Brighton, and Sussex Worthing), and four South East Water zones (WRZ2, WRZ3, WRZ4, and WRZ5). The spatial relationship between the potential development locations and the respective water resource zones is illustrated in Figure 3.2. The development sites in relation to the water resource zone from which they would most likely be supplied are listed in Table 3.1.

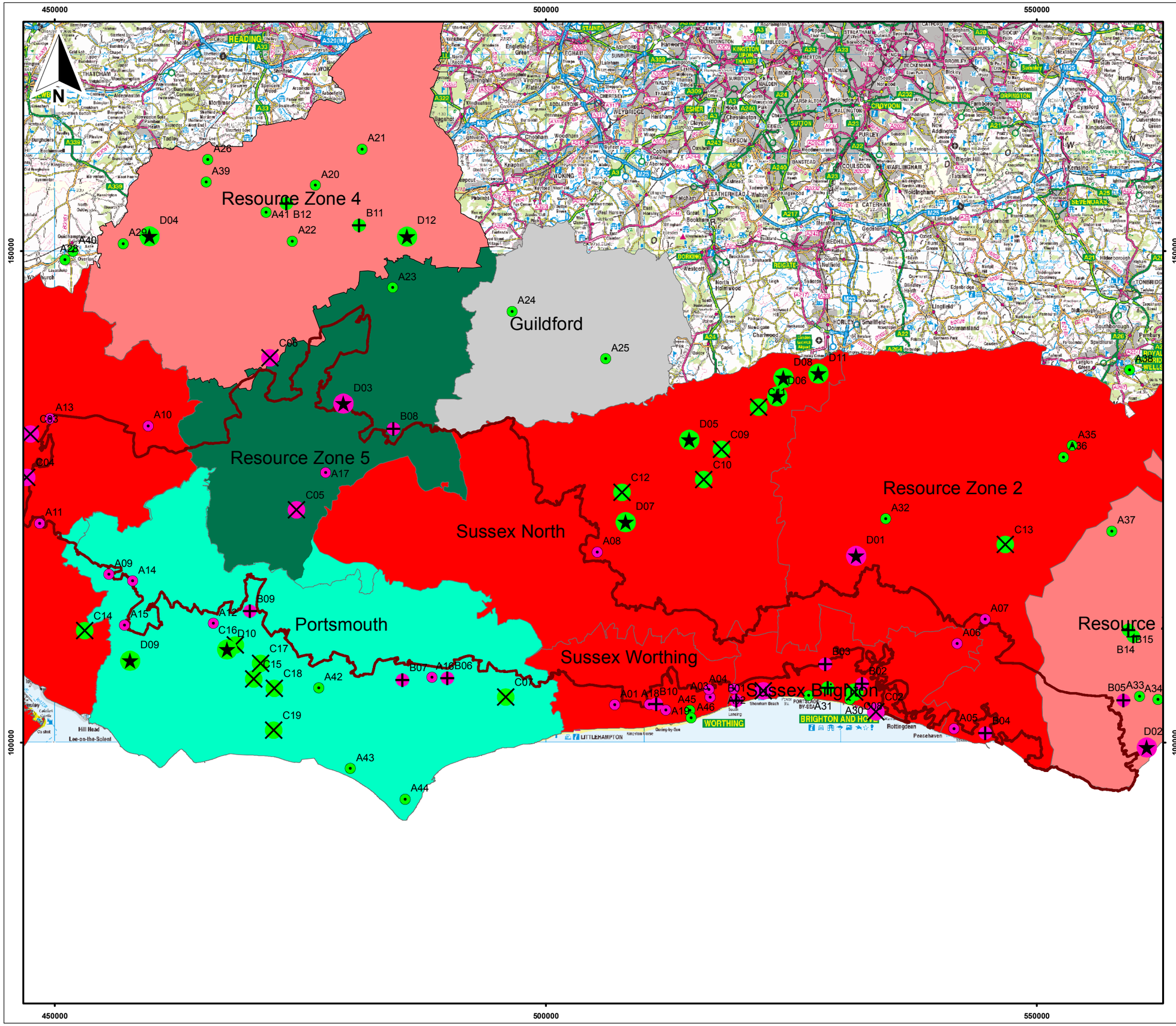
Information used in this Scoping Assessment is taken from Southern Water's Revised Draft (May 2014) Water Resource Management Plan; South East Water's Water Resource Management Plan which has been approved by Defra (June 2014); and Portsmouth Water's Draft Water Resource Management Plan, all of which were available on the water company websites during 2014.

Table 3.2 Potential strategic developments by water resource zone

Water Co.	WRZ	Strategic housing developments within the study area				Strategic housing developments outside of the study area
		100-500 houses	500-1000 houses	1000-3000 houses	3000+ houses	
Southern Water	Hampshire South	A10, A11, A13	0	C03, C04	0	C014
	Sussex North	A08	0	0	0	C009, C010, C011, C012, D005, D006, D007, D008, D011
	Sussex Worthing	A1, A3, A4, A18, A19	B10	0	0	A045, A046
	Sussex Brighton	A2, A6	B1, B2, B3	C1, C2	0	A030, A031, B013, C008
South East Water	Resource Zone 2	A7, A5	B04	0	D01	A032, A035, A036, C013
	Resource Zone 3	0	B05	0	D02	A033, A034, A037, B014, B015.
	Resource Zone 4	0	0	C06	0	A020, A021, A022, A0026, A029, A039, A041, B011, B012, D004, D012
	Resource Zone 5	A17	B08	C05	D03	A023

Water Co.	WRZ	Strategic housing developments within the study area				Strategic housing developments outside of the study area
		100-500 houses	500-1000 houses	1000-3000 houses	3000+ houses	
Portsmouth	Company area	A9, A12, A14, A15, A16	B6, B7, B9	0	0	A042, A043, A044, C017, C015, C016, C017, C018, C019, D009, D010

Planned development data sourced from the SDNPA Access Network and Accessible Natural Greenspace Study.



Key:

- South Downs NPA

Water Company

- PortsmouthWaterBoundary
- South East Water
- Southern Water
- Thames Water

"Hants South" Resource Zone

Major Planned Developments

- 100 - 500 houses
- 500 - 1000 houses
- 1000 - 3000 houses
- 3000+ houses

0 20,000 Metres

Scale: 1:375000 @ A3

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South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 3.2
Planned Development and Resource Zones

December 2014
35227-Bri14.mxd ryans

3.2.2 Water resource situation

Water Stress

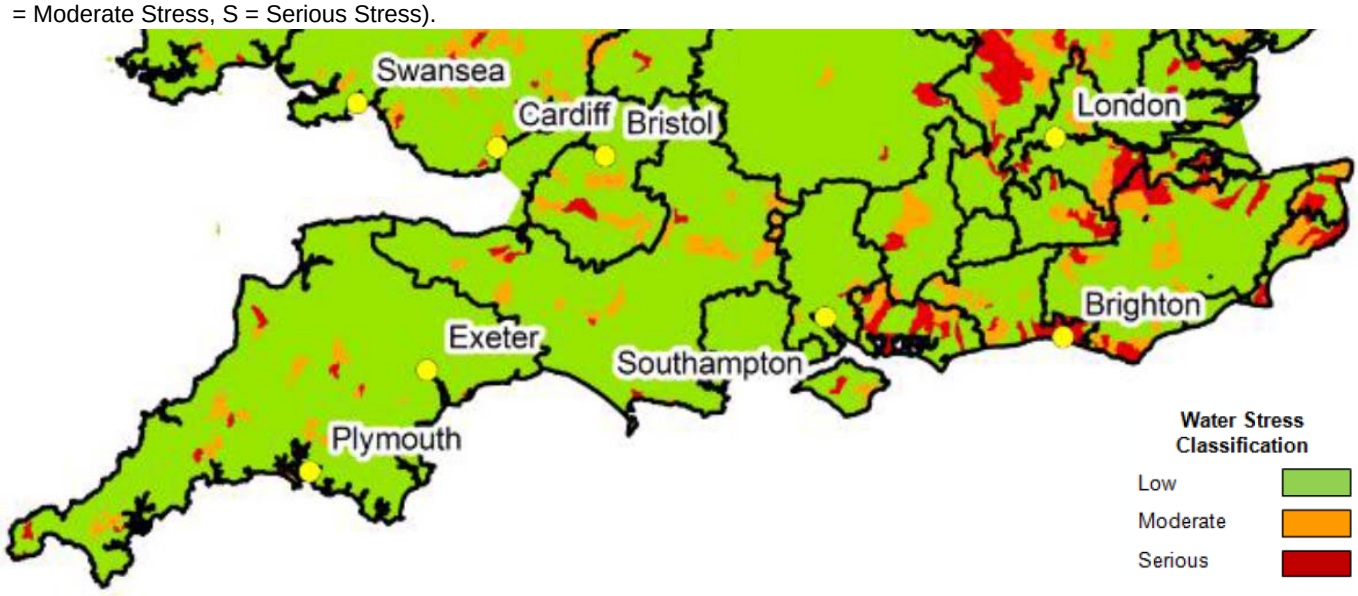
In 2013 the Environment Agency carried out a classification of water stress in water company areas. It determined the water stress for each water body based on a water balance calculation. It then aggregated the water stress across all waterbodies from which there is a public water supply abstraction to classify water stress classification at the water resource zone level, and then aggregated these to give a classification for each water company. It examined current stress and future stress under different climate change and demand scenarios.

It classified Southern Water and South East Water as under "Serious Stress" and Portsmouth Water as under "Moderate Stress" (Figure 3.3). The classification gives no indication of water company performance or ability to meet current or future demand. However the assessment is used by the Environment Agency to outline areas where companies should consider compulsory metering in their plans alongside other demand management options.

Figure 3.3 Water stress assessment in the region of the study area

Water Company Area	2013 Classification					
	Current Stress	Future Scenario 1	Future Scenario 2	Future Scenario 3	Future Scenario 4	Final Stress
Portsmouth Water	M	S	M	S	M	Not Serious
South East Water	S	S	S	S	S	Serious
Southern Water	S	S	S	S	S	Serious

Water company stress classification showing how the current and future scenarios have been combined (L = Low stress, M = Moderate Stress, S = Serious Stress).



Extracts from: Environment Agency (2013). *Water stressed areas – final classification* (Table 1 and Figure 2: Map showing final water body stress classification at a water body scale).

Note: The water company stress classification may classify chalk streams, such as the River Meon, as water stressed despite having a good ecological status.

Water company plans

The water companies publish their supply-demand balance forecasts within their WRMPs and they consider two different types of scenario: dry year annual average (DYAA); and dry year critical period (DYCP). The DYAA represents average conditions across a year that experiences less than normal rainfall and the DYCP represents a peak period within that dry year when resources are particularly critical. This is typically a week coinciding with summer holidays, or a summer bank holiday. The specific definition of the critical period varies between companies. In many cases water companies have abstraction licensing arrangements that are specifically designed to support supplies during the critical period. This explains why sometimes the DYCP situation does not have a deficit when in the DYAA situation there may be a problem.

If a deficit is forecast under DYAA or DYCP conditions and those conditions were to occur (i.e. reduced rainfall situation) the reality of a deficit means that the water company may have to introduce restrictions on use for as long as the conditions are experienced. This is not the same as a drought (which is another specific type of scenario that the water companies plan for).

The initial forecast, referred to as the ***baseline*** takes into account the best available information and assumptions on demand (e.g. expected population change and per capita consumption levels) and supply (this includes the impact of climate change and known environmental constraints on resource availability plus any schemes that the company already has plans and funding to introduce).

Table 3.3 summarises the current situation and the baseline forecast and is in line with the Environment Agency's water stress assessment. Whilst there are pockets of surplus water available on the whole the region has a number of existing deficit issues and there are some major deficit issues forecast which the water companies have to respond to.

Table 3.3 Summary of the baseline water resource situation

Company	WRZ	Deployable output (Ml/d)*	Development Sites	2015/16 situation	Forecast situation (baseline)	Zone issues/comments
Southern Water	Hampshire South	250	A10, A11, A13, C3, C04	A large surplus.	Rapidly drops into deficit sustained across the entire planning period (to 2040).	Risk of saline intrusion into this coastal zone where 37% of supply is from groundwater. Sustainability reduction to River Itchen licences required by 2018.
	Sussex North	50	A08	A deficit in the dry year. A small surplus during the critical period.	Dry year deficit forecast to continue becoming more severe and deficit emerges in the critical period.	Import from Portsmouth Water will reduce by 5 Ml/d from 2021.
	Sussex Worthing	55	A01, A03, A04, A18, A19, B10	A small surplus in both scenarios.	The small surplus rapidly falls into a sustained deficit.	Most of the demand on water resources in this zone is from outside of the study area. Risk of saline intrusion into this coastal zone where 98% of supply is from groundwater.
	Sussex Brighton	93	A02, A06, B01, B02, B03, C01, C02	A small surplus in the dry year and a balance in the critical period.	Sustained deficits becoming increasingly severe in both scenarios.	Most of the demand on water resources in this zone is from outside of the study area. Risk of saline intrusion into this coastal zone where 100% of supply is from groundwater.
South East Water	Resource Zone 2	73	A07, A05, B04, D01	A deficit in the dry year scenario but a small surplus in critical period conditions.	Deficits in both scenarios becoming increasingly severe.	55% of water is supplied by 2 surface water sources, 38% of water is supplied by 14 groundwater sources (from the Ashdown Beds and Chalk – at risk of saline intrusion), 7% of water is transferred from Southern Water (contract review in 2021). Possible risk of saline intrusion to groundwater sources near the coast.

Company	WRZ	Deployable output (Ml/d)*	Development Sites	2015/16 situation	Forecast situation (baseline)	Zone issues/comments
	Resource Zone 3	67	B05, D02	A small dry year surplus but a small deficit in the critical period.	Dry year surplus sustained until 2029/30 from when a small deficit will increase. The critical period deficit is sustained and becomes increasingly severe.	Possible risk of saline intrusion to groundwater sources near the coast.
	Resource Zone 4	193	C06	A reasonable sized surplus in the dry year scenario but a deficit in critical period conditions.	A sustained but declining surplus in the dry year until 2040 when a deficit is forecast. The critical period deficit is sustained and becomes increasingly severe.	
	Resource Zone 5	53	A17, B08, C05, D03	A large surplus in both scenarios.	The dry year surplus is sustained although degrades slightly over time. The critical period surplus declines slightly but is boosted in 2039/40.	15% of supply is from an Affinity Water bulk supply. This value may change or vary as SEW are developing their own River Thames source in Resource Zone 4.
Portsmouth	Company area	245.5	A09, A12, A14, A15, A16, B06, B07, B09	No deficit.	No deficit (large surplus).	No baseline deficit forecast, but zone is entirely reliant on groundwater. Portsmouth Water provides a bulk supply to Southern Water.

Ml/d: Megalitres per day (1 million litres)

2015/16 deployable output values for South East Water were taken from line BL7 in the WRMP Dry Year Annual Average tables located on the water company websites. For Southern Water MDO (Minimum Deployable Output) values are used. For Portsmouth Water 2015/16 deployable output values were taken from Section 6.2 of the WRMP.

Table 3.3 includes a quantity of 'Deployable Output' for each WR zone. Deployable Output (DO) is a specific term that quantifies how much water is available to the company to put into supply (after environmental constraints and other factors such as pumping and treatment capacity are taken into account). This gives an indication of the relative volumes of water available across the zones. Summaries of the supply-demand balance detail taken from the WRMP tables are available in Appendix B.

3.2.3 Demand forecasts and South Downs development plans

When considering these assessments of water resource availability and the forecast supply-demand balance it is vital to understand if the proposed development plans are part of the demand forecast, or additional. The Outline Assessment examines this issue.

3.2.4 Supply-demand balance solutions

Table 3.3 clearly presents the baseline water resource situation and shows that action needs to be taken in seven of the water resource zones in order to secure supplies for customers in the future. A major component of the WRMPs is the company preferred solution, the ***final planning*** forecast. This is developed from a range of potential solutions that are appraised in terms of suitability to solve the problem; technical, social, and environmental feasibility, and cost-effectiveness. Once the companies have decided on their preferred plans the forecasts are re-run to illustrate the impact of options to manage demand on the demand forecast, and the impact of new resource or other supply-side options on the supply forecast. The final plan is subject to approval by Ofwat under the Periodic Review of Prices process.

Water companies do not plan investment that will generate unnecessary volumes of water as this would essentially mean investing more, and charging their customers more than is required. Water companies therefore plan to deliver final planning supply-demand forecasts with a zero balance (no deficit, no surplus). The WRMP data demonstrates that all seven of the nine water resource zones which have baseline forecast deficits are resolved in the final planning scenario. Further details of the options that will secure this situation are presented in the Outline Assessment.

3.2.5 Other significant water resource issues

Saline intrusion

The increase in abstraction required to support dry year peak demands risks generating a hydraulic gradient and saline intrusion into the coastal aquifer. This risk is also sensitive to sea level change. Portsmouth Water confirms that some of its groundwater abstractions are taken from springs rather than boreholes and so do not draw down the aquifer. Southern Water also reports the risk of saline intrusion into coastal aquifers which can severely restrict yields at times of low groundwater levels. Faced with increasing chloride levels, the company may have to reduce abstraction in the short term in order to protect supplies in the future'. This issue could require that Southern Water reduces abstraction from coastal groundwater sources in Hampshire South, Sussex Worthing, and Sussex Brighton zones over the short term. The issue is not considered in the WRMPs of South East Water or Portsmouth Water.

Private water abstractors

There are many private abstractors in the study area 'upstream' of public water supply abstractions. Assessment of these is beyond the scope of this project but they contribute to the range of factors that constrain the options available to the water companies to increase their resource via increased abstraction.

3.3 Water supply networks

All three of the water supply companies have indicated that generally they do not anticipate any significant issues relating to connecting any of the proposed potential development sites to the existing supply network and that whilst inevitably installing additional infrastructure takes time, they are all confident that this could be accommodated within the normal timescales of progressing large-scale housing developments. The companies confirm that they respond to information from Local Authority planners regarding growth and they plan and implement network upgrades in-line with the information they receive. Figures 3.4 to 3.6 have been supplied by the water companies to illustrate some of the main water supply infrastructure features in the zones supplying the study area.

Figure 3.4 Strategic reservoirs and water transfers in the Southern Water company area

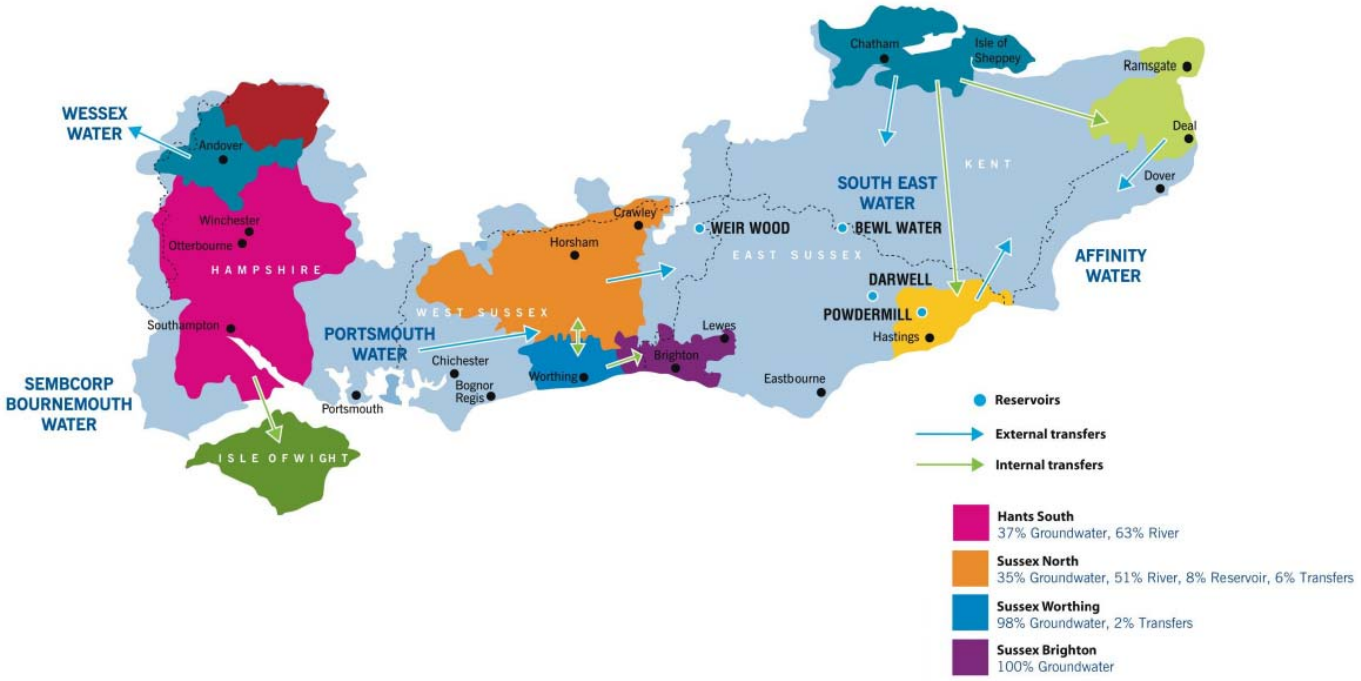


Image adapted from Revised Draft Water Resources Management Plan – Technical Report. Legend adapted to list water resource zones relevant to the study area.

Southern Water has confirmed that there are no trunk main issues relating to the proposed development sites within its supply area but recognises that smaller scale local issues may arise in relation to specific developments. The

transfer illustrated by the blue arrow from the Sussex North zone into the county of East Sussex, is the transfer into South East Water's Water Resource Zone 2 (Figure 3.5).

Figure 3.5 Strategic supply sources in South East Water Resource Zone 2 and 5

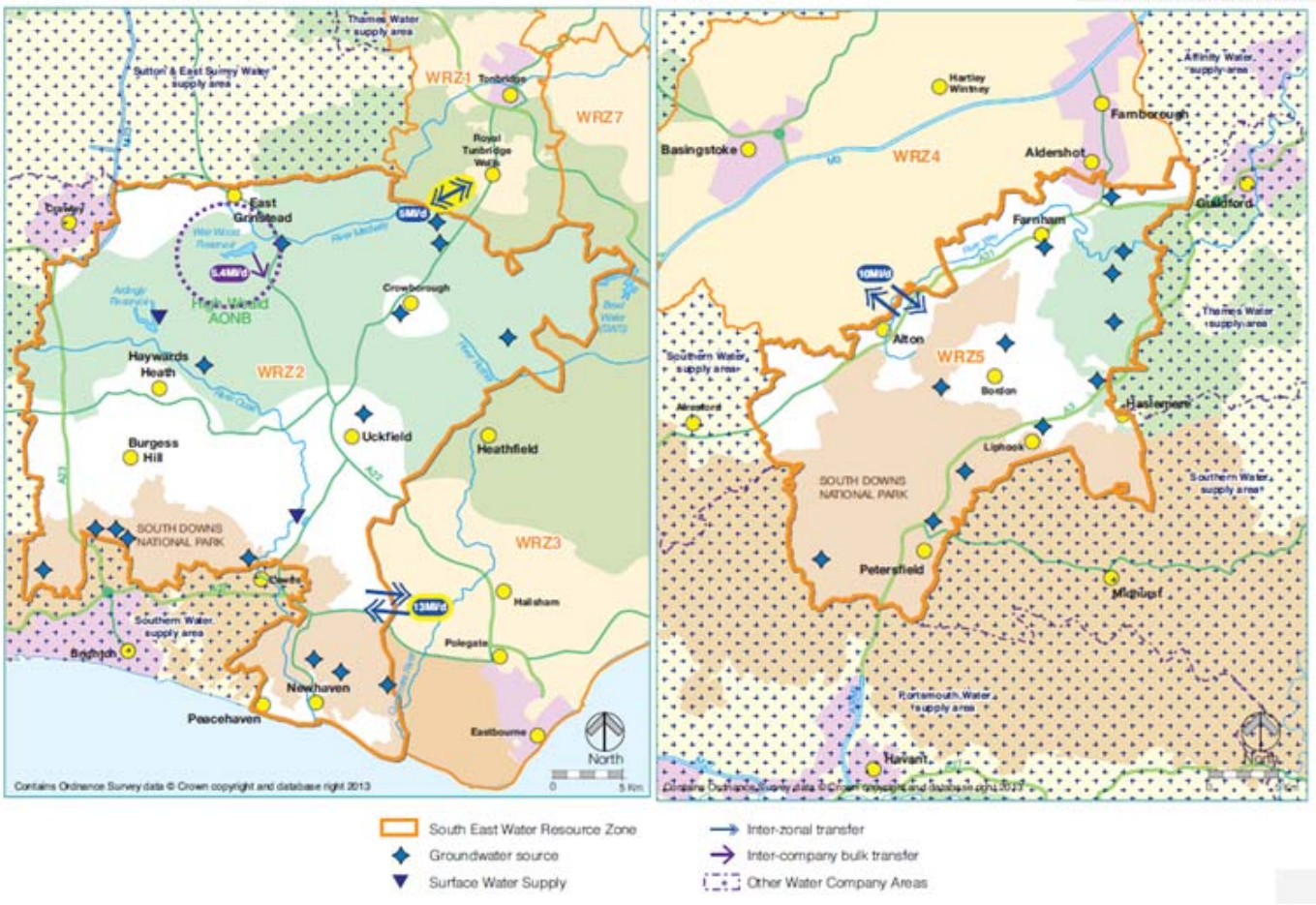


Image available in the Revised Draft Water Resource Management Plan (section 3: supply forecast).

Seven percent of the water supplied to customers in this zone is provided via a transfer from Southern Water (from Weir Wood Reservoir – highlighted in the dashed circle). South East Water manages the rest of its supply from numerous groundwater sources, Ardingley Reservoir, an abstraction from the River Ouse and inter-zonal transfers (WRZ1 and WRZ3).

Figure 3.6 Strategic water supply links in the Portsmouth Water zone

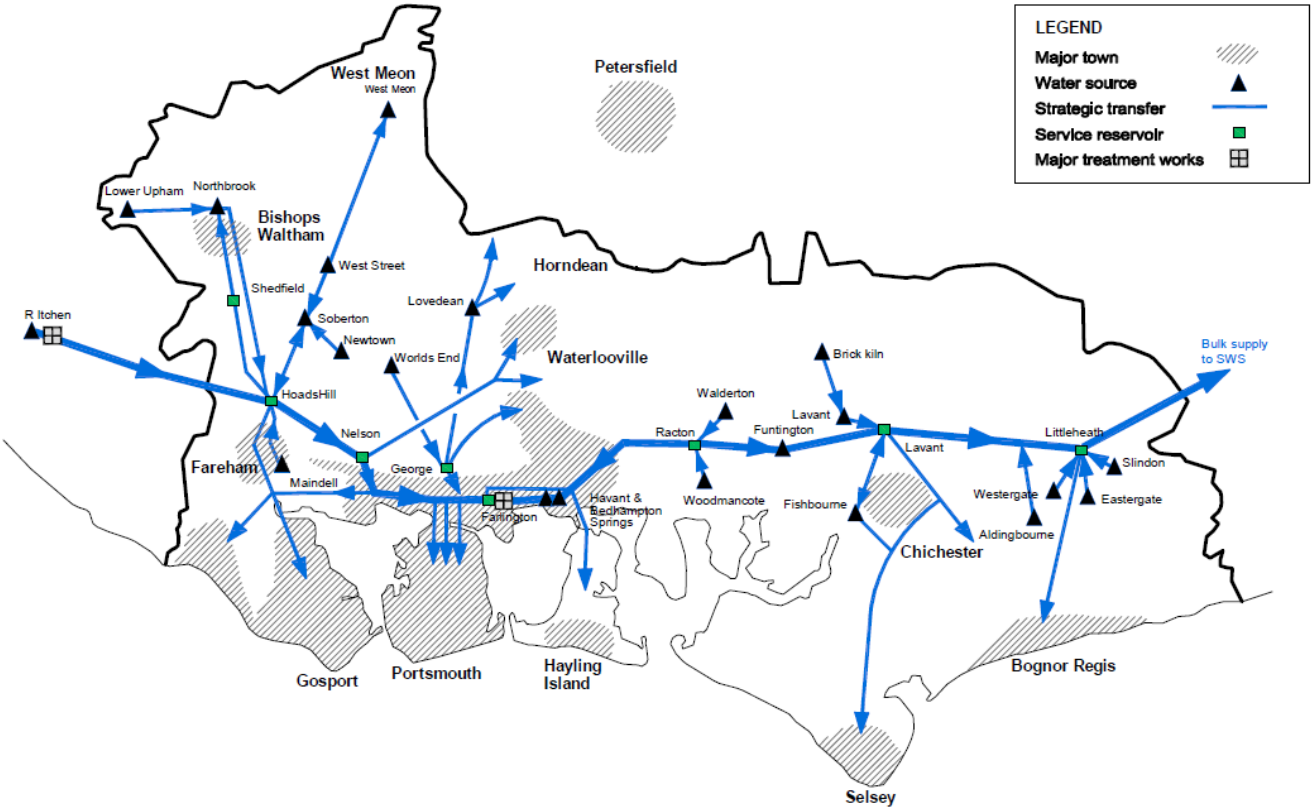


Image provided by Portsmouth Water. Drawing number 80/284D. Date 31/10/12.

This images illustrates the core transfers linking thepredominantly groundwater sources to the major demand centres served by Portsmouth Water. The image does not show th e extent of the suppl y distribution network. Two key features are the transfer of water fro m a surface water abstraction on the River Itchen to the West of the com pany boundary, and the bulk supply transfer exporting water to So uthern Water. Oth er than the Itchen water treatment works, there is only m ajor water treatment works in the area at Far lington. There are other smaller s cale treatment works. With the exception of Havant and Bedham pton Springs none of the supply sources are constrained in terms of how much water they can put into supply (within licensed limits) by the capacity of the treatment works.

3.4 Summary of water resource scoping assessment

All of the water resource zones except Ports mouth Water and Water Resource Zone 5 of South East Water fall into supply-demand deficit during the baseline forecasting period in the water resource plans. All three water companies (including Portsmouth Water) are required to take action to work together to manage the deficits using a combination of new sources, improving the conjunctive use of exi sting sources, and reducing custo mer demand for water. The final plans for each water resource zone set out how the water companies plan to address the deficits and restore the supply demand balance. Providing the water companies carry out the final plans effectively this Scoping Assessment has found no significant issues which would impact on the ability to meet the supply needs of the new developments. The Outline Assessment presents the wide r water resource context to help un derstand the sustainability issues of development in the region. It considers:

- The demand assumptions within the ***final planning*** solutions including growth rate and demand management options, the implications for aspirations of water neutral development, and the actions that SDNPA could support; and

- The factors constraining the options that are available to the water companies to increase supply (e.g. the impact of Habitats Directive sustainability reductions (required by the Environment Agency) and Catchment Abstraction Management Strategies on options to secure water supplies).

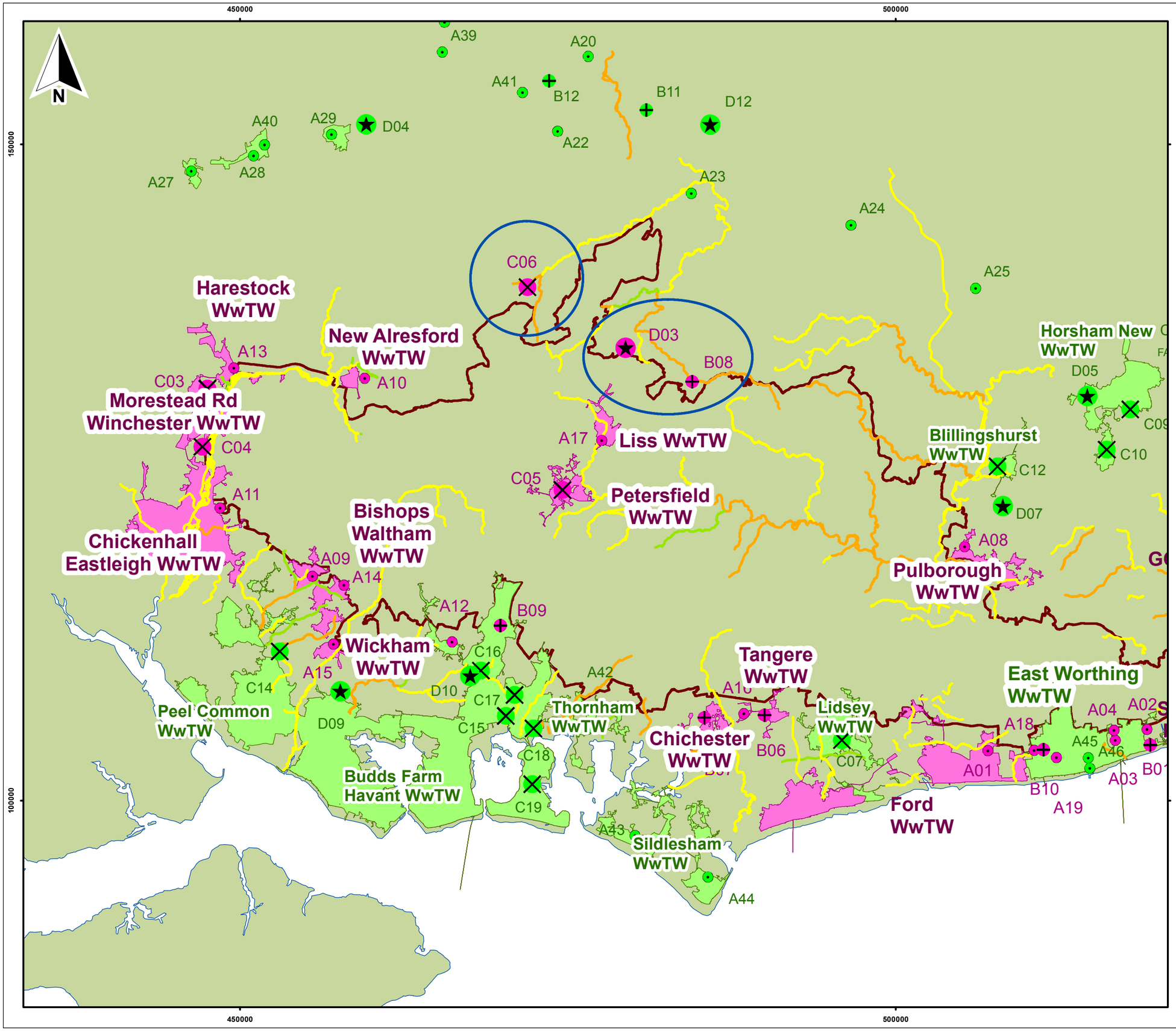
3.5 Wastewater treatment and water quality

This section of the Scoping Assessment examines whether wastewater treatment capacity or the sewerage network are potential constraints to the growth plans being considered by SDNPA. The Scoping Assessment examines the treatment works in relation to the proposed potential large-scale development sites. It does not consider the wastewater treatment works (WwTW) serving areas in which no strategic growth is currently being considered.

3.5.1 Treatment works in the study area

The Scoping Assessment identifies which of the wastewater treatment catchment areas have potential strategic development sites located within them. All sites within the study area (including the 2km buffer zone) are included and Southern Water and Thames Water have provided information on the capacity at these treatment works.

The vast majority of the study area and the development sites within it are served by Southern Water. In total the study area is intersected by 86 Southern Water wastewater treatment catchments. A small part of the northern tip of the study area is served by two treatment works operated by Thames Water. Thames Water confirms that sites B08 and D03 would be served by Bordon WwTW and site C06 would be served by Alton WwTW. Figure 3.7 illustrates the wastewater treatment catchment areas in relation to the potential large-scale strategic development sites and a list is provided in Table 3.4



Key:

South Downs NPA

Wastewater treament works catchment areas:

- Strategic growth sites in study area
- Includes strategic growth sites beyond study area
- Thames Water wastewater treatment catchment areas

Receiving water courses:

Ecological Status:

- Good
- Moderate
- Poor
- Bad

Potential strategic development sites (within study area)

- 100 - 500 new homes
- 500 - 1000 new homes
- 1000 - 3000 new homes
- 3000+ new homes

Potential strategic development sites (beyond study area)

- 100 - 500 new homes
- 500 - 1000 new homes
- 1000 - 3000 new homes
- 3000+ new homes

0 3 6 12 Kilometers

H:\Projects\35227 South Downs Water Cycle Study\Drawings

South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 3.7a
Wastewater treatment works catchments (western half)

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amec

500000

550000

150000

100000

N

A21

20

B11

D12

2

A23

A24

A25

D03

B08

7

Liss WwTW

Petersfield WwTW

Blillingshurst WwTW

C12

D07

A08

Pulborough WwTW

C10

C09

D05

Horsham New WwTW

C11

D08

D11

D06

Faygate WwTW

Scaynes Hill WwTW

Goddards Green WwTW

D01

Uckfield WwTW

C13

A37

Tunbridge Wells South WwTW

A38

A35

A36

Redgate Mill, Crowborough WwTW

Neave Lane Ringmer WwTW

A07

A06

B15

Hailsham North WwTW

B14

Hailsham South WwTW

A34

Eastbourne WwTW

D02

B04

Newhaven East WwTW

A05

Portobello Brighton WwTW

C08

A30

C02

B03

B02

B13

A31

C01

Shoreham WwTW

A04

A02

A45

A46

A03

B01

A18

A01

B10

A19

East Worthing WwTW

Ford WwTW

Lidsey WwTW

C07

Tangere WwTW

Chichester WwTW

B06

A42

A44

Sildlesham WwTW

Key:

South Downs NPA

Wastewater treament works catchment areas:

Strategic growth sites in study area

Includes strategic growth sites beyond study area

Thames Water wastewater treatment catchment areas

Receiving water courses:

Ecological Status:

Good

Moderate

Poor

Bad

Potential strategic development sites (within study area)

100 - 500 new homes

500 - 1000 new homes

1000 - 3000 new homes

3000+ new homes

Potential strategic development sites (beyond study area)

100 - 500 new homes

500 - 1000 new homes

1000 - 3000 new homes

3000+ new homes

0 3.5 7 14 Kilometers

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South Downs National Park Authority Water Cycle Study and Strategic Flood Risk Assessment

Figure 3.6b
Wastewater treatment works catchments (eastern half)

June 2014
35227-Bri16.mxd ryans

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Some treatment works serve individual urban areas (e.g. South Harting WwTW) whilst others serve multiple towns and villages (e.g. South Ambersham WwTW – no growth expected in this WwTW catchment). 25 treatment works' catchment areas serve settlements within and outside of the National Park itself. The size of these treatment works, in terms of the population they can serve varies across the study area although population equivalent data is not available for the Scoping Assessment.

In addition to this are a further five treatment works whose catchment areas extend beyond the study area and include potential strategic growth sites outside of the study area (East Worthing, Portobello Brighton, Budds Farm Havant, Hailsham South, and Eastbourne). Table 3.4 lists these together with an indication of the additional strategic growth that they could potentially be required to serve. This additional growth is included within the District Council's individual Local Plan growth considerations, and as such have been taken into account by Southern Water.

There are other treatment works across the study area which could potentially accommodate growth if the SDNPA has cause to reconsider its proposed sites. Identifying and investigating the capacity at these additional works is beyond the scope of this study.

Table 3.4 Potential strategic development sites and affected treatment works

Water Co.	WwTW	Strategic housing developments within the study area				Developments outside of the study area
		100-500 houses	500-1000 houses	1000-3000 houses	3000+ houses	
Southern Water	Ford	A01	-	-	-	
	East Worthing	A02, A03, A04, A18, A19	B01, B10	-	-	A45, A46
	Portobello Brighton	A05	B02, B03	C02	-	A30, A31, B13, C8
	Newhaven East	A06	B04	-	-	
	Neaves Lane Ringmer	A07	-	-	-	
	Pulborough	A08	-	-	-	
	Bishops Waltham	A09, A14	-	-	-	
	New Alresford	A10	-	-	-	
	Chickenhall Eastleigh	A11	-	-	-	
	Budds Farm Havant	A12	B09	-	-	C15, C16, C17,C18,C19, D10
	Harestock	A13	-	C03	-	
	Wickham	A15	-	-	-	
	Tangmere	A16	B06	-	-	
	Liss	A17	-	-	-	

Water Co.	WwTW	Strategic housing developments within the study area				Developments outside of the study area
		100-500 houses	500-1000 houses	1000-3000 houses	3000+ houses	
	Hailsham South	-	B05	-	-	A33
	Chichester	-	B07	-	-	
	Shoreham	-	-	C01	-	
	Morestead Rd Winchester	-	-	C04	-	
	Petersfield	-	-	C05	-	
	Goddards Green	-	-	-	D01	
	Eastbourne	-	-	-	D02	A34
Thames Water	Alton	-	-	C06	-	
	Bordon	-	B08	-	D03	

3.5.2 Wastewater treatment capacity

Water Framework Directive and water quality

The European Water Framework Directive (WFD) is driving improvements in river water quality. As a minimum the WFD sets a mandatory target of 'no deterioration' in the water quality of receiving waters (into which wastewater treatment works discharge treated effluent) below current conditions. Secondly, it sets a target for river water to meet 'Good Ecological Status' (as defined by numerous water quality parameters) by 2015 (unless the water quality status was classified as 'Bad' in the first round of RBMPs in 2009 and for which the target to meet Good Status has been deferred from 2015 to 2027). In cases where investigations conclude that achieving Good Status will not be achievable, or if the work to achieve it will be technicallyunfeasible or disproportionately expensive the second cycle of RBMPs *may* adjust the objective (e.g. to moderate status) to reflect something achievable by the specific river waterbody. However, they may also retain the deferred timescale to meet Good Status.

In 2009, in the first cycle of the River Basin Management Plan process, the Environment Agency examined the quality of the water courses including those within the study area and classified the majority of those within the study are as either Moderate or Poor Ecological Status. Only a small number were classified at Good Ecological Status[13]. Across the South East River Basin as a whole, the 2009 assessment concluded that 81 percent of the surface waterbodies did not meet 'Good Status' criteria (69 percent were Moderate, 12 percent were Poor, and 1 percent were Bad).

[13] http://maps.environment-agency.gov.uk/wiyby/

There are multiple factors contributing to the failure of watercourses to achieve Good Status: point source discharges from treatment works, diffuse source pollution from agriculture, water abstraction, plus the implications of physical modifications to the waterbody [14]. The Good Status (or potential) requirement is derogated (removed) if the factors causing the failure to meet Good Status are considered essential on their own terms, e.g. flood protection and essential drinking water supply (these are overriding policy objectives). In such cases all appropriate mitigation measures must still be applied [15]. If the cause of the failure is due to some other important activity (e.g. power generation) then the requirement may also be derogated but only if it passes three tests: the alternatives are technically impossible, that they are prohibitively expensive, or they produce a worse overall environmental result.

Some waterbodies are 'Heavily Modified', i.e. due to navigational or other functional requirements. In these situations it may be unfeasible to achieve Good Status, instead these waterbodies are classified in terms of their 'Potential' rather than 'Status'. The WFD is implemented within across defined 'River Basins' and the study area is located within the South East River Basin.

UK wastewater discharge permitting

In the UK wastewater treatment works (WwTW) are issued with environmental permits to limit pollution of the watercourses receiving treated effluent ('receiving waters'). This permit includes a flow limit based on Dry Weather Flow (DWF). The rationale is that in dry weather the flow volume of the receiving water is at its lowest, resulting in reduced dilution of effluent. In dry weather, the effluent volume is expected to be the product of domestic and industrial sewage flows, without additional flows from surface runoff. DWF is currently defined in UK practice as the total daily flow value that is exceeded by 80% of the total daily flow values in any period of twelve months.

Study area treatment capacity

Southern Water and Thames Water have provided information on the capacity within their treatment works that would serve the potential development sites and the results are summarised in Table 3.5. Capacity is determined by DWF and permitted quality parameters.

Table 3.5 Existing wastewater treatment capacity in relation to potential strategic demand

Company	Treatment works	Potential development sites*	Capacity assessment
Southern Water	Liss, Petersfield, Bishops Waltham, Newhaven East, New Alresford, Eastbourne, Ford, Harestock, Shoreham, Pulborough, Morestead Road Winchester, Neaves Lane Ringmer, Wickham, East Worthing, Portobello Brighton, Budds Farm Havant, Goddards Green, Chickenhall Eastleigh.	A01, A02, A03, A04, A05, A06, A07, A08, A09, A10, A11, A12, A13, A14, A15, A17, A18, A19, B01, B02, B03, B04, B09, B10, C01,C02, C03, C04, C05, D01, D02.	There is sufficient Dry Weather Flow headroom in the existing environmental permits to accommodate the development scenario.

[14] Environment Agency (2009), River Basin Management Plan South East River Basin District
[15] http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm

	Hailsham South	B05	Hailsham South has sufficient headroom to accomodate the maximum proposed growth plans. In addition to this Southern Water is investigating options to further increase capacity in the future.
Southern Water	Tangmere	A16, B06	There is insufficient Dry Water Flow headroom in the existing environmental permit to accommodate the development scenario. Further capacity can be provided and has been agreed by the Environment Agency. Limited capacity until 2019. See comment re Aldinbourne Rife
	Chichester	B07	There is currently limited capacity in the Chichester catchment due to groundwater infiltration. There is sufficient capacity to accommodate the level of development in the draft Chichester Local Plan when considered in combination with additional capacity at Tangmere WwTW. Further development will require upgrades which are currently under investigation. The catchment for Chichester treatment works is located outside the South Downs National Park boundary but SDNPA is responsible for planning large scale strategic sites across the wider area (section 1.2).
Thames Water	Bordon	B08 D03	**Adequate capacity for approx 2000 homes** (only relatively minor works needed), but if growth exceeds this then a more substantial upgrade will be needed.
	Alton	C06	Alton has capacity for the growth plans which include around 1000 homes from 2016. Minor improvements such as aeration capacity would be needed to support this. Any growth in addition to this will exceed the site capacity and require a more substantial upgrade.
*Category A developments: 100 – 500 new homes; category B developments: 500 – 1000 new homes; category C developments: 1000 – 3000 new homes; category C developments: >3000 new homes.			

Southern Water wastewater treatment

Southern Water has already undertaken initial capacity assessments based on the planning data submitted by the individual Local Authorities (as described in section 3.1 the planning data in this study is composed of and equal to the sum of the strategic sites listed in those individual District Council datasets). Southern Water has confirmed that most of its wastewater treatment works identified in this Scoping Assessment have capacity within their environmental permits to accommodate some additional volume and some additional load. The main limitation for additional capacity for wastewater treatment is currently at Tangmere WwTW.

Two strategic development sites (A16 and B06) are proposed within the catchment area of Tangmere WwTW. The catchments for both Tangmere WwTW and Chichester WwTW are wholly located outside the National Park but SDNPA is responsible for planning large strategic development sites across the wider area beyond its own physical boundary (section 1.2). Tangmere WwTW has limited headroom to accommodate some, but not all of the potential new development. If both A16 and B06 were to be taken forward in their entirety (maximum 1500 new homes) this would exceed the capacity of the existing discharge permit. To accommodate the maximum proposed development

the Environment Agency would need to grant a change to the Tangmere WwTW discharge permit to increase the consented Dry Weather Flow (i.e. to process higher volumes). In order to protect the quality of the receiving water against the increase volume of treated effluent the quality of the discharge water would need to be further improved, probably requiring an upgrade in the level of treatment offered at the site).

Tangmere WwTW discharges into the Aldingbourne Rife. According to the latest publicly available information on waterbody status (Water Framework Directive – Surface Water Classification Status16) from 2012 the Aldingbourne Rife has Moderate status. However, information provided by Portsmouth Water suggests this may have declined to 'Bad' status (WFD) which represents a deterioration. There are concerns that this watercourse will struggle to support receipt of more sewage effluent. Environmental studies undertaken by Portsmouth Water have shown that the WFD conditions in the Rife apply during both low and high flows. However, Southern Water has recognised that process capacity (volumes treated) is a concern at Tangmere WwTW and has included an investment scheme to provide additional capacity in its Business Plan for the investment period 2015 to 2020. The scheme is scheduled to be constructed by 2019, subject to Ofwat approval. In addition to these water quality issues the Aldingbourne Rife is also experiencing flooding problems (see section 5.1.2).

The catchment of Chichester WwTW, which is operated by Southern Water, includes growth point B07 (potential development of up to 1000 homes). The Chichester WwTW catchment experiences groundwater infiltration, which limits the available capacity at the WwTW, and Southern Water is looking into the feasibility of options to reduce infiltration. Development on the outskirts of Chichester City (west, north and east) can also be diverted to Tangmere WTW where additional capacity can be provided to serve the development.

Southern Water and the Chichester Water Quality Group previously assessed the capacity of Chichester WwTW to serve the demand proposed in the Chichester Local Plan (of which the large-scale developments have been transferred into the SDNPA plan) and concluded that in combination with the limited headroom at Tangmere WwTW maximum growth at the B07 site could be accommodated. This would be instead of accommodating growth at A16 and B06. The small headroom at the existing Tangmere WwTW and Chichester WwTW could theoretically be used to support a little growth at all three sites, but certainly not all of it.

The Chichester Water Quality Group concluded that Chichester WwTW cannot be relied upon for wastewater infrastructure to accommodate housing requirements due to limited volumetric capacity and could not be upgraded due to environmental constraints[6]. The Environment Agency has advised Southern Water not to use the limited headroom that is available at Chichester WwTW until a sustainable long-term solution to the capacity issue is found. AMP 6 investigations may provide a solution through reducing infiltration at Chichester WwTW although the Chichester Water Quality Group preferred solution is to upgrade Tangmere WwTW. At present, existing infrastructure cannot support proposed development at Chichester.

In light of these comments, strategic development sites A16, B06, and B07 may be better phased later in the development programme. The Outline Assessment examines these constraints in the context of the more detailed SHLAA development plan data and confirms which treatment works would serve each development.

[16] http://data.gov.uk/dataset/wfd-surface-water-classification-status-and-objectives

Regular dialogue takes place between key stakeholders including Chichester District Council, Environment Agency, Natural England, Southern Water, and Chichester Harbour Conservancy regarding these issues and identifying alternative solutions to the need to accommodate increased growth [17]. It is recommended that the South Downs National Park Authority joins this group and that dialogue on growth and sustainability should continue.

Development site B05 would be served by the Hailsham South WwTW, which could also be required to serve site A33 (100-500 homes, outside of the study area). Southern Water states that there is sufficient headroom at Hailsham South WwTW to accommodate the level of development "set out in Wealden's adopted Core Strategy". Wealden's plan includes up to 700 homes on a site referred to as "Land south of Polegate and East of Willingdon". This is the same site which is referred to as B05 (development in the range of 500-1000 new homes). These growth demands could be accommodated but would leave very little, if any, headroom for other developments. Southern Water draws attention to a study that is underway to identify a preferred solution to deliver additional wastewater treatment capacity in south Wealden to accommodate development in future, and that a preferred solution will be published by the end of March 2015.

Southern Water's assessment indicates that the Harestock, Shoreham, Morestead Road Winchester, East Worthing, Portobello Brighton, and Budds Farm Havant WwTWs have capacity to serve the identified allocated sites up to and beyond 3000 new homes (the environmental permit has more capacity than would be demanded by the development as set out in the SHLAA data – section 4.1). In particular, Southern Water states that there is significant headroom to support additional development at the Portobello Brighton and Budds Farm Havant treatment works.

Thames Water wastewater treatment

Thames Water has provided information on the capacity available at Bordon WwTW and Alton WwTW to accommodate the growth plans. The environmental permit limits and recent actual data (volumes and quality limits) provided by Thames Water indicate that both treatment works have capacity to accommodate some growth, as both are currently operating well within their existing process and permitted quality limits. However, as shown in Table 3.5 this headroom is not sufficient to support the maximum development figures:

Bordon WwTW:

- Permit to discharge a maximum of 8790 m^3/d "Dry Weather flow" (DWF). The observed recent actual (since 2011) DWF has been approximately three quarters of this [18];
- Permit to discharge the following concentrations : 25mg/l of Suspended Solids, 10mg/l Biological Oxygen Demand (BOD), and 4mg/l Ammonia – measured at 95 percentile flows, and 2mg/l Phosphorous measured at the 50 percentile, measured at average flows. Actual observed discharges have been equal to or lower than these maximum limits.

Bordon WwTW has capacity to serve up to new 2000 homes, but some "*relatively minor works [would be] needed*" *[Pers. Comms., Thames Water]* to accommodate this. SDNPAs development plans indicate a potential maximum of

[17] Chichester Water Quality Group (2012), Water Quality and Strategic Growth for Chichester District Background Paper
[18] confidential data not available to publish

4000 new homes between sites B08 (500-1000 homes) and D03 (>3000 homes). Bordon WwTW could be upgraded or a new WwTW could be built but these options are currently no more than considerations for a future dem and scenario and as it currently stands Thames Water has no plans to increase capacity at Bordon WwTW. At this stage it is important to flag the potential time delays that could be incurred if SDNPA opts to bring forward large-scale (>2000) development at these sites in advance of Thames Water being able to include provision to upgrade within the next round of business plans for implementation in AMP7 (2020-2025).

Alton WwTW:

- Is a slightly bigger treatment works than Bordon and has a permit to discharge a maximum of 12,915 m^3/d "Dry Weather flow" (DWF). The obser ved recent actual (since 2011) DWF has been approximately two thirds of this;

- Permit to discharge the following concentrations : 25mg/l of Suspended Sol ids, 11mg/l Biological Oxygen Demand (BOD), and 4mg/l Ammonia – m easured at 95 percentile flows, and 2m g/l Phosphorous measured at the 50 percentile, average flows. Actual observed discharges have been equal to or lower than these maximum limits.

The potential number of new homes at site C06 i n the Alton WwTW catch ment will be between 1000 and 3000. There is a small amount of headroom at Alton WwTW which could serve approximately 1000 homes [*Pers. Comms., Thames Water re SOLAR project*] although this will require so me small scale upgrades. This 1000 is not allocated to any specific potential developments. Any growth beyond 1000 homes will exceed capacity at Alton and require a substantial upgrade. Thames Water has not prepared plans to significantly change the treatment processes or make any other significant improvements to the works during AMP6 (2015-2020) and so growth beyond 1000 homes could be subject to significant delayed phasing.

Thames Water also confirms that the Newmans Lane Sewer Pumping Station (SPS) / Storm Tank and Outfall which supports Alton WwTW is also operating at capacity and so is una ble to support any additional sewerage demand. Thames Water intends to use the Local Authorities new deve lopment projections to review and update the existing process model that it uses to review available capacity and identify the im provements that are required to accommodate an increase in load to Alton WwTW [*Pers. Comms., Thames Water*]. Thames Water has not provided GIS or other maps of the catch ment areas served by Bordon WwTW or Alton WwTW and so it is not possible to confirm if the treatment area catchments are completely contained within the East Hampshire local authority area.

Issues identified in Table 3.5 are examined further in the Outline Assessment, in particular confirmation of treatment works serving sites in the SHLAA development data and recommendations to phase development where necessary.

Impact of WFD objectives on options to increase capacity

The WFD assessments an d challenging water quality targets m ean that there are already significant challenges to improve the water quality in this area and it is within this context that options to increase treatment work capacity are constrained. T his is particularly significant for Alton WwTW, Bo rdon WwTW, Tangmere WwTW, and Chichester WwTW which will require changes to their permits to accommodate additional growth.

Since then there has been various investigative work in the region but updated status assessments made in 2012 show that the receiving waters for these treatment works remain unchanged. It is during the second and third management cycles that waterbodies in this area are required to benefit from implementation projects to improve the water quality issues and achieve 'Good Status'.

This section presents the water quality situation of the receiving waters associated with the four treatment works for which permit changes may be required (to support the higher levels of growth) and the deadlines to achieve the WFD objectives:

- Bordon WwTW: discharges into the southern reaches of the River Wey which is currently at Moderate Status due primarily to elevated levels of phosphorous leading to a borderline eutrophic condition;
- Alton WwTW: discharges into the Caker Stream (part of the Wey catchment) which is currently at Moderate Status due primarily to biological conditions (invertebrates) falling short of 'Good';
- Tangmere WwTW: discharges into the Aldingbourne Rife which is currently at Moderate Status. Problems include: low dissolved oxygen, flow volumes and flow dynamics, borderline eutrophic due to elevated levels of phosphorous; and
- Chichester WwTW: discharges into coastal waters (Chichester Harbour) which is currently at Moderate Potential due primarily to Dissolved Inorganic Nitrogen levels. This is a heavily modified water body and so status is restricted to 'Potential'.

(The data used is the 2012 Water Framework Directive – Surface Water Classification Status and Objectives. Portsmouth Water has stated that a more recent investigation for the 2013 status assessment has shown that the Aldingbourne Rife has dropped to Bad status, which is a deterioration, and which increases the pressure on Tangmere WwTW to improve the quality of the treated effluent)

The deadline for all four of these receiving waters to reach Good Status (or Good Potential) is 2027. The Environment Agency is undertaking investigations into the causes and sources of elevated phosphorous levels. Following that investigation it is possible that Southern Water and Thames Water will be required to improve the level of phosphorous removal at the treatment works. This could require structural investment at the WwTW and increased operational costs for the treatment process.

Table 3.6 Receiving water WFD classification and the water issues

WwTW / receiving water	WFD Status	Water quality issues	Impact on Growth Plans
Tangmere WwTW Aldingbourne Rife	Moderate Status Disproportionately expensive and technically infeasible to achieve Good status by 2015. Objective to reach Good Status by 2027.	• Low dissolved oxygen levels within the waterbody. Cause is uncertain. Further investigation required; • Flow volumes and dynamics do not support Good Status. Further investigation is required to confirm failure to meet WFD objectives; • Borderline eutrophic due to elevated levels of phosphorous (P). The source is unconfirmed, although it could be the WwTW. Evidence required to control the eutrophication risk is insufficient.	Tangmere WwTW may be subject to tighter quality permits, or additional structural changes to the works to meet the requirements of WFD prior to 2027. Impacts on options to increase the discharge permit.
Chichester WwTW Chichester Harbour, a coastal waterbody	Moderate Potential Objective to reach Good Potential by 2027.	The WFD deadline extended because: • Insufficient evidence to confirm the need to control eutrophication risk posed by the levels of Dissolved Inorganic Nitrogen (DIN) within Chichester Harbour; • The Harbour is heavily modified and the effectiveness of measures to mitigate the impacts of this on the ecological status are uncertain.	The factors preventing the Harbour from reaching Good Status are unlikely to be related to Chichester WwTW.
Bordon WwTW River Wey (southern)	Moderate Status Disproportionately expensive to achieve Good Status by 2015. Objective to reach Good Status by 2027.	• Borderline eutrophic due to elevated levels of phosphorous (P). The source is unconfirmed, although it could be the WwTW. Evidence required to control the eutrophication risk is insufficient.	Bordon WwTW may be subject to tighter quality consents, or additional structural changes to the works to meet the requirements of WFD prior to 2027. Impacts on options to increase the discharge permit.
Alton WwTW Caker Stream, part of the River Wey catchment	Moderate Status Technically infeasible to achieve Good Status by 2015. Objective to reach Good Status by 2027.	• Biological element is known to be at less than Good Status, however the pressure causing the impact is not known.	The factors preventing the Harbour from reaching Good Status are unlikely to be related to Alton WwTW.

(Environment Agency, 2009).

3.5.3 Small package plants

'Package plants' are typically standalone decentralised treatment works which serve small populations. They are usually pre-engineered and pre-fabricated with treatment systems (unlike septic tanks which discharge to soakaway) and wastewater is discharged (under a permit) into a watercourse.

A significant proportion of the South Downs National Park is rural in nature, with mainly small scattered settlements, rather than large urban centres. These smaller settlements are often widely distributed across the countryside and can sometimes include individual houses/farms. These smaller clusters of settlements are often not connected to the main

sewerage network, and sewage is treated by septic tanks or small sewage treatment plants [19]. The waste from these is discharged to ground through a soak-away or to a nearby river or stream[7].

Large-scale strategic development sites will, most likely be connected to the mains sewerage system and treated at centralised wastewater treatment works. However, it is useful to draw attention to this issue as supporting information for smaller scale development applications.

Property owners are responsible for meeting standard requirements to ensure their waste water systems are in good order and are well maintained to prevent pollution[7]. In 2014 Defra is consulting [20] on proposed changes to package plant arrangements to protect vulnerable areas, such as Source Protection Zones (SPZs) which relate to water supply sources, and designated sensitive areas. The proposed changes include introducing permits to regulate discharge from small sewage treatment plants located in the most sensitive water supply areas and the designated sensitive areas.

There is a chalk aquifer beneath the SDNPA area and any spills or non-compliant discharges from package plants within the National Park could negatively impact the water quality objectives of the groundwater which is a source of drinking water.

3.5.4 Sewerage

In the same way that supply networks are managed in response to planning information from the Local Authorities, sewerage upgrades are planned and delivered in the same way. It is important that there is capacity available within the sewerage network to accommodate growth as lack of capacity can lead to sewer flooding. Southern Water and Thames Water have provided overview information in relation to sewer flooding/capacity issues in relation to the treatment works catchment areas serving the proposed large-scale strategic development sites.

Southern water

Southern Water aims to provide sewerage capacity in parallel with housing development, whilst recognising that economic factors and developer aspirations can influence development plan priorities different to those anticipated in the Local Plan.

The existing capacity of the sewerage network and the ability to provide additional capacity when required are important considerations. Southern Water recognises that there are some properties in the WwTW catchments at risk of sewer flooding due to overloaded sewers (referred to as DG5 properties). Whilst this may sound alarming the company states, "*this is not a fundamental showstopper to new development. Development can take place provided it connects to the local sewerage system at the nearest point of adequate capacity. This will ensure that the existing situation is not made worse.*" Southern Water's approach to deal with this, in light of new development pressures is to identify and prioritise opportunities to reduce the risk of sewer flooding whilst providing capacity for new

[19] Defra, (2014), Consultation on reform of the regulatory system to control small sewage discharges from septic tanks and small sewage treatment plants in England
[20] closes on 10 June 2014

development in trunk sewers [*Pers. Comms., Southern Water*]. Southern Water confirms that new development could create opportunities to upgrade sewer infrastructure.

Southern Water looks to the South Downs Local Plan to support this approach as it will identify the location and scale of development, enabling sewer planning to take place. Where there are more complex issues South Downs National Park Authority is encouraged to work in partnership with other agencies with responsibilities for drainage such as the Lead Local Flood Authorities [*Pers. Comms., Southern Water*].

Thames Water

Thames Water states that within the two wastewater treatment catchment areas (Bordon WwTW and Alton WwTW) serving the three potential development sites (B08, C06, and D03) "*The network and* [sewer pumping station] *SPS are capable of receiving foul flows based on current housing.*" but there could be some capacity constraints to resolve to serve the proposed developments:

- Site D03: Wastewater in the area drains under gravity to the pumping station. This has insufficient capacity to accommodate proposed development and in its current state the sewerage network capacity in this area is unlikely to be able to support the increased demand. Sewerage upgrades are likely to be required to support growth;

- Site B08: Thames Water is concerned about the capacity of the sewerage network infrastructure in the area that drains to Bordon WwTW. Occasionally, during prolonged wet weather there are serviceability and capacity problems;

- Site C06: Alton WwTW receives pumped flows from three pumping stations: Newman Lane SPS; Holybourne SPS; and Caker Stream Road SPS. Newman Lane SPS is the principal terminal pumping station as the sewage treatment works storm storage and overflow facilities are located on this site. Sewerage from most of the proposed C06 development would drain to this SPS and infrastructure upgrades in the network and at the pumping station would be required to accommodate proposed growth.

Thames Water indicates that due to the nature of the sewerage network every connection request has to be dealt with on an individual site-by-site basis, and any required infrastructure upgrades are identified through an associated detailed impact assessment. Thames Water has the same approach as Southern Water to aligning sewerage upgrades with strategic housing developments, "*Depending on the impact and certainty of the development, Thames Water, funding dependant, would programme in any infrastructure work required*" [*pers. Comms., Thames Water*]. Thames Water identifies capacity limits and delivers network upgrades through the 5 year asset planning process. Growth needs are prioritised and those with the greatest need are delivered first. Alternatively a developer may wish to work with Thames Water to agree a solution that can be delivered sooner although this can have funding implications for the developer.

The sewerage network across the SDNPA are a is unlikely to pose an absolute constraint to development plans although there are areas which require attention. Planning, phasing, and communicating plans and progress between the SDNPA, developers, and water companies will be central to the success of these projects.

3.5.5 Scoping assessment of wastewater treatment capacity

This Scoping Assessment has found that whilst there are a number of wastewater and sewerage issues that need to be better understood as the development plans progress and become more specific, these do not constitute absolute constraints to growth.

Most of the potential lower level growth could be accommodated by existing treatment capacity but the higher 'maximum' levels could be problematic in places. Maximum growth at sites draining to Tangmere WwTW, Chichester WwTW, Bordon WwTW, and Alton WwTW would be constrained by the existing capacity. Investment in upgrades and possibly additional infrastructure may be required to accommodate maximum growth, if required, at these sites. Communication between the SDNPA, developers, and the water companies will be critical.

The Outline Assessment expands on the issues identified in this Scoping Assessment. Specifically it:

- Examines in more detail the sites draining to Tangmere and Chichester WwTWs and the combined capacity issue;
- Examines further the upgrades required to process the additional volumes of wastewater generated by the new sites at Tangmere WwTW, Chichester WwTW, Bordon WwTW, and Alton WwTW;
- Clarifies the sewerage route that the wastewater from the new developments in the Alton WwTW catchment would take to reach Alton WwTW; and
- Clarifies the outcomes of the Environment Agency's investigations into the sources of phosphorous in the Tangmere and Bordon WwTW catchments.

3.6 Overall scoping conclusions

Chapter 3 has presented the various elements of the environmental and infrastructure water cycle and identified a range of baseline capacity issues and constraints that will require resolution before growth and the demands that it generates can be accommodated. Table 3.7 summarises these baseline issues and confirms which sites and which issues are examined further in the Outline Assessment.

Table 3.7 Matrix summary of constraints identified by the Scoping Assessment

Site code	Local Authority	Water resources	Water supply*	Wastewater treatment	Sewerage**	Flood risk***
A01	Arun	Deficits		Capacity available		GW (possible) & SW (possible)
A02	Adur	Deficits		Capacity available		Tidal & Fluvial & GW (possible) & SW (possible)
A03	Adur	Deficits		Capacity available		Tidal & Fluvial & GW (possible) & SW (possible)
A04	Adur	Deficits		Capacity available		GW (possible) & SW (possible)

Site code	Local Authority	Water resources	Water supply*	Wastewater treatment	Sewerage**	Flood risk***
A05	Lewes	Deficits		Capacity available		SW (possible)
A06	Lewes	Deficits		Capacity available		Tidal & Fluvial & GW (likely) & SW (possible)
A07	Lewes	Deficits		Capacity available		SW (possible)
A08	Horsham	Deficits		Capacity available		SW (possible)
A09	Winchester	Large surplus		Capacity available		SW (possible)
A10	Winchester	Deficits		Capacity available		GW (possible) & SW (possible)
A11	Winchester	Deficits		Capacity available		SW (possible)
A12	Winchester	Large surplus		Capacity available		SW (possible)
A13	Winchester	Deficits		Capacity available		GW (possible) & SW (possible)
A14	Winchester	Large surplus		Capacity available		GW (possible) & SW (possible)
A15	Winchester	Large surplus		Capacity available		SW (possible)
A16	Chichester	Large surplus		Tangmere WwTw is constrained		SW (possible)
A17	East Hampshire	Surplus		Capacity available		Fluvial & SW (possible)
A18	Worthing	Deficits		Capacity available		GW (possible) & SW (possible)
A19	Worthing	Deficits		Capacity available		GW (possible) & SW (possible)
B01	Adur	Deficits		Capacity available		Tidal & Fluvial & GW & SW (possible)
B02	Brighton & Hove	Deficits		Capacity available		GW (possible) & SW (possible)
B03	Brighton & Hove	Deficits		Capacity available		GW (possible) & SW (possible)
B04	Lewes	Deficits		Capacity available		Tidal & Fluvial & SW (possible)
B05	Wealden	Deficits		Capacity available		Tidal (possible) & Fluvial (possible) & SW (possible)
B06	Chichester	Large surplus		Tangmere WwTw is constrained		SW (possible)
B07	Chichester	Large surplus		Chichester WwTW is constrained		SW (possible)
B08	East Hampshire	Large surplus		Bordon WwTW is constrained	Occasional capacity problems in wet weather	Fluvial & SW (possible)
B09	East Hampshire	Large surplus		Capacity available		GW (possible) & SW (possible)
B10	Worthing	Deficits		Capacity available		Tidal (possible) & Fluvial (possible) & SW (possible)

Site code	Local Authority	Water resources	Water supply*	Wastewater treatment	Sewerage**	Flood risk***
C01	Adur	Deficits		Capacity available		Tidal & Fluvial &GW & SW (possible)
C02	Brighton & Hove	Deficits		Capacity available		Tidal & SW (possible)
C03	Winchester	Deficits		Capacity available		GW (possible) & SW (possible)
C04	Winchester	Deficits		Capacity available		Fluvial & GW (possible) & SW (possible)
C05	East Hampshire	Surplus		Capacity available		Fluvial & SW (possible)
C06	East Hampshire	Critical period deficit		Alton WwTW is constrained	Upgrades required at Newman Lane SPS	Fluvial & GW (possible) & SW (possible)
D01	Mid Sussex	Deficits		Capacity available		Fluvial (possible) & SW (possible)
D02	Eastbourne	Critical period deficit		Capacity available		Tidal (possible) & Fluvial (possible) & GW (possible) & SW (possible)
D03	East Hampshire	Surplus		Bordon WwTW is constrained	Insufficient capacity at PS upgrades required	SW (possible)

*Small scale local issues may arise in relation to specific developments

**Development expected to create opportunities to access and improve sewerage infrastructure and reduce risks to all customers (assessed within the baseline flood risk characterisation, section 5.1)

*** Individual flood risk elements without '(possible)' suffix are definite risks

GW = Groundwater

SW = Surface water

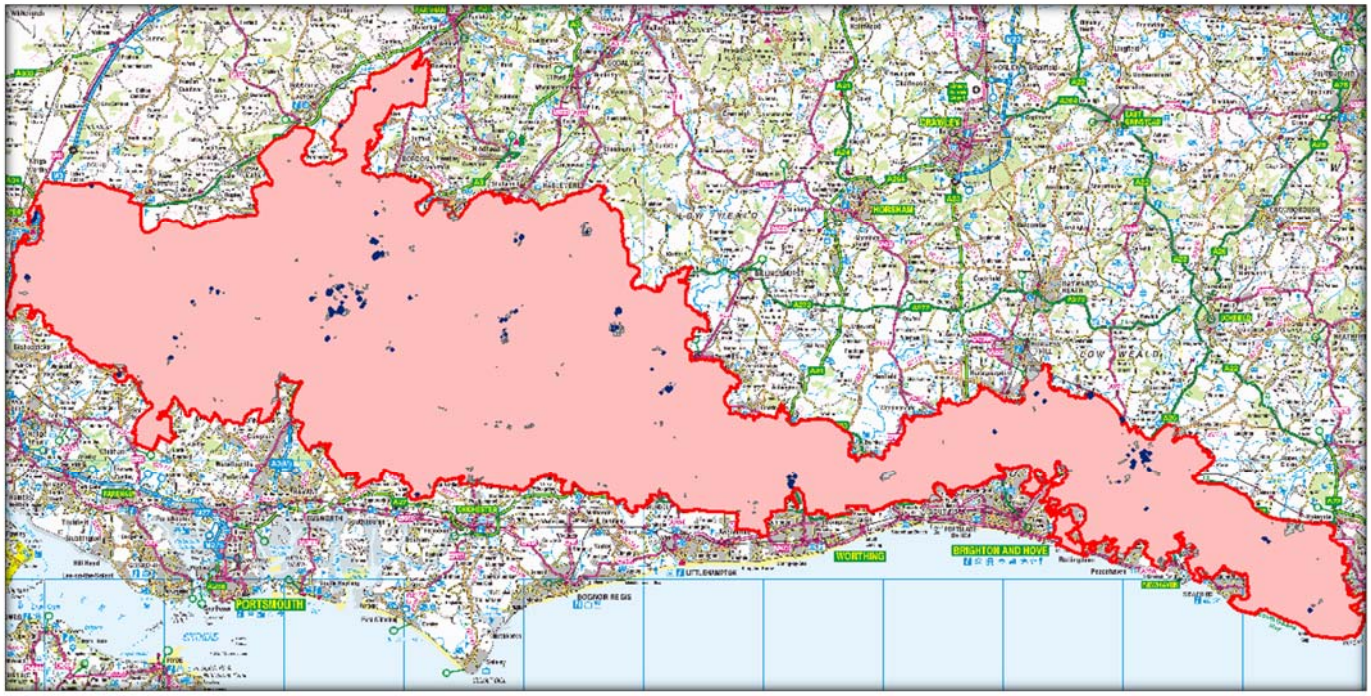
4. Water Cycle Study Outline Assessment

4.1 SHLAA data

In August 2014 the SHLAA data was provided to the water cycle study and Level 1 SFRA. A total of 432 individual sites has been reduced to 95 accepted sites with a combined total yield of 2395 new homes: 1497 to be built within 0-5 years, 674 to be built between 6 and 10 years, and 134 to be built 11-15 years from now. These are all located within the SDNP area (Figure 4.1). The SHLAA data and the Outline Assessment is restricted to the South Downs National Park boundary. The sites are listed in Table 4.1. Information on the disaggregation by area and over time is applied in section 6, Proposed Strategy for Development.

The primary aim of the Outline Assessment is to identify potential environmental and water infrastructure limitations to development to provide an evidence base to support the Local Plan and identification of preferred sites for development. The SDNPA Strategic Housing and Land Availability Assessment (SHLAA) data is applied during Outline Assessment enabling second phase assessments to relate the issues more specifically to proposed development sites. This level of information is particularly important for SFRA.

Figure 4.1 SHLAA sites used in the outline assessment



Greyed out sites have not progressed to accepted status by South Downs National Park Authority.

Table 4.1 Detailed development plans (accepted SHLAA sites)

Site reference*	Location	Yield	Timeframe (years from 2014)
EA050	Land at Penns Field, Petersfield	89	0-5
EA001	Holt Leigh House, Back Lane, Bucks Horn Oak	9	0-5
EA002	Land at Clements Close, Binstead	10	0-5
EA005	Land at Greenways and Kiln Lanes	5	0-5
EA022	Liss Forest Nurseries, Petersfield Road, Greatham	34	11-15
EA034	Land at Inwood Road, Liss	25	0-5
EA038	Land at Hilliers Nurseries, Andlers Ash Road, Liss	100	0-5
EA043	Kippences, Farnham Road/ Station Road, Liss	30	0-5
EA054	Land at Larcombe Road, Petersfield	71	0-5
EA062	Land at the Causeway	136	6-10
EA070	Land West of Bell Hill, Petersfield	28	0-5
EA074	Land to the west of the Causeway, Petersfield	64	0-5
EA078	Land East of Pullens Lane, Petersfield	5	0-5
EA055	Land South of Durford Road, Petersfield	48	0-5
EA097	Land East of Hays Cottages, Steep	10	0-5
EA101	Land at Park Farm, Blanket Street, Worldham	10	0-5
CH063	Former Allotment Land, West of Eastbourne	14	0-5
CH027	Lower Nappers Farm	7	0-5
CH025	Fernhurst Glebe	13	0-5
CH032	Land at Fleet Cottage, The Fleet	5	0-5
CH062	Petersfield Road	40	0-5
CH096	Land North of Northend Close	20	0-5
CH098	Land at Woodlea, Northmead	13	0-5
CH088	Land East of Hampers Common Industrial estate	35	0-5
CH090	Laundery Cottage and land to North	7	0-5
CH094	Square Field	70	0-5
CH100	Land South of Rothermead	8	0-5
CH092	Land to the rear of Rothermead	5	0-5
CH075	Land at Luffs Meadow	8	0-5
CH118	Land South of Lopper Ash	8	0-5
CH125	Land South of Heather Close	30	0-5
MI005	Land between Church Lane and A23	10	0-5
LE035	Former Southern Water Works Site, Ham Lane	60	0-5
LE030	Riverside - Cliffe	13	0-5
LE050	High Street, Lewes	7	0-5
LE032	Clayhill Nursery	41	0-5
LE012	Land at South Downs Road	53	0-5
LE046	Pinwell Road	17	6-10
LE042	Land between Walwers Lane and Church, Lewes	35	0-5
LE040	All in North Street Lewes	390	0-10
LE051	Landport Club and Garages	8	6-10
LE039	East Sussex County Council, County Hall	100	11-15
LE004	Former Roche site, Bell Lane	14	0-5
LE036	Southover High Street, Lewes	9	0-5
LE005	Lewes Road, Ditchling	15	0-5
LE016	Land at North End	30	6-10
LE014	land to the South of Wellgreen Lane	6	0-5
WI021	land at Corhampton Lane	15	0-5
WI025	Northend Lane	10	6-10
WI004	Northfields Farm	6	0-5
WI020	Northfields Farm	10	0-5
WI005	Northfields Farm	48	0-5
WI015	Floud Lane and Long Priors	14	0-5
WI009	West Meon, Petersfield	5	6-10
WI028	Land off Lippen Lane	6	0-5
CH128	Park Crescent, Midhurst	10	0-5
CH133	Former Garden to West Lavington Hill House	10	0-5
WE002	Land behind The Fridays, Gilberts Drive,	14	0-5
WE005	Land at West Street	6	0-5

Site reference*	Location	Yield	Timeframe (years from 2014)
EA108	Lower Tilmore, Tilmore Road, Petersfield	5	0-5
CH135 (a)	Tripp Hill Farmhouse Paddocks, Lower Horncroft	5	6-10
CH134	Land at Holmbush Way	6	0-5
Ch061	Garage site at New Road,	5	0-5
CH085	Garage Site at Martlett Road	5	0-5
CH104	Land at Parsonage	5	0-5
CH110	Garage Site at Parsonage	6	0-5
CH146	East of Littlecote (Rotherlea)	25	0-5
WE011	Former Allotment Site	6	6-10
WI034	Dykes Farm, Easton Lane	45	0-5
WI035	Itchen Abbas House	8	0-5
WI040	Hoe Road Sports Ground	45	6-10
HO014	Land West of Besley Farmhouse	5	0-5
HO015	Land at Brookland Way,	20	0-5
LE082	North of existing Hollycroft	8	0-5
LE083	Hollycroft, Chapel Lane	5	0-5
LE090	Land at Beechwood Lane	12	0-5
EA051	Land at Buckmore Farm,	73	0-5
EA115	Community Centre, Love Lane	10	6-10
AR010	Soldiers Field Yard, Nepcote Lane	6	0-5
AR018	Soldiers Field House, Soldiers Field Lane	5	0-5
AR021	Well Cottage/Priory Cottage/Crossways, Cross Lane	7	0-5
AR020	Findon Towers	7	0-5
AR015	Findon Manor Hotel, High Street	12	0-5
AR008	Roger's Farm Garden Centre and former allotments	8	0-5
EA057	Land in High Street, Dragon Street and St Peter's Road	19	6-10
EA112	HCC Depot off Paddock Way	30	6-10
EA116	Land to North of Reservoir Lane	11	0-5
LE059	St Mary's Social Centre, Christie Road	8	6-10
LE060	Juggs Road	5	0-5
LE057	Land and Building West of North Street	10	0-5
LE055	Magistrates Court, Friars Walk	20	0-5
LE056	Magistrates Court car park, Court Road	15	0-5
LE086	Land adjacent to Sunnyside and Ouseside Cottages, Newhaven Road	9	0-5
CH022	Garage site at Old Glebe	5	0-5
	Total:	**2395**	

*Applied by South Downs National Park Authority between Scoping and Outline stages

4.2 Water resources and supply

The Scoping Assessment identified that the 7 out of the 9 zones that supply the SDNP forecast deficits and that all three water companies (including Portsmouth Water) are required to take cooperative action to manage the deficits. In this Outline Assessment the outcomes of the companies' ***final planning*** solutions are examined particularly the factors constraining options to increase supply, the assumptions underpinning the demand forecasts, and the actions required for those solutions to be delivered.

Information used in this Outline Assessment is taken from Southern Water's Final Water Resource Management Plan (October 2014), South East Water's Water Resource Management Plan which has been approved by Defra (June 2014), and Portsmouth Water's Final Water Resource Management Plan (August 2014), all of which have been available on the water company websites.

Table 4.2 SHLAA developments by water resource zone

Water Co.	WRZ	SHLAA sites (Site reference)	Estimated housing yield	Baseline WRZ assessment
Southern Water	**Hampshire South**	WI004, WI020, WI005, WI034, WI035	**117**	Sustained deficit
	Sussex North	CH063, CH032, CH062, CH096, CH098, CH088, CH090, CH094, CH100, CH092, CH075, CH118, CH128, CH133, CH135 (a), CH134, Ch061, CH085, CH104, CH110, CH146, HO014, HO015.	**335**	Sustained deficit
	Sussex Worthing	AR010, AR018, AR021, AR020, AR015, AR008	45	Sustained deficit
	Sussex Brighton	MI005, LE035, LE030, LE050, LE032, LE012, LE046, LE042, LE040, LE051, LE039, LE004, LE036, LE014, LE059, LE060, LE057, LE055, LE056.	**821**	Sustained deficit
South East Water	Resource Zone 2	LE005, LE016, LE082, LE083, LE090, LE086.	79	Deficit increasingly severe
	Resource Zone 3	WE002, WE005, WE011.	26	Surplus until 2029/30 (DYAA). **Sustained deficit in DYCP.**
	Resource Zone 4	EA002	10	Surplus until 2040 (DYAA). **Sustained deficit in DYCP.**
	Resource Zone 5	EA050, EA001, EA005, EA022, EA034, EA038, EA043, EA054, EA062, EA070, EA074, EA078, EA055, EA097, EA101, CH027, CH025, EA108, EA051, EA115, EA057, EA112, EA116, CH022.	**837**	Declining surplus
Portsmouth	**Company area**	CH125, WI021, WI025, WI015, WI009, WI028, WI040.	125	Surplus
	Total		**2,395**	

Taking the estimated housing yield into account, it is clear that the focus for this study should be on RZ 5 (where there is a surplus) and Sussex Brighton (where there is a sustained deficit) and to a lesser extent Sussex North (deficit), Hampshire South (deficit), and Portsmouth (surplus). Table 4.3 shows that 93 percent of the total proposed housing development is within these five resource zones.

Table 4.3 Summary of the water resource 'solutions' in the Water Resource Management Plans

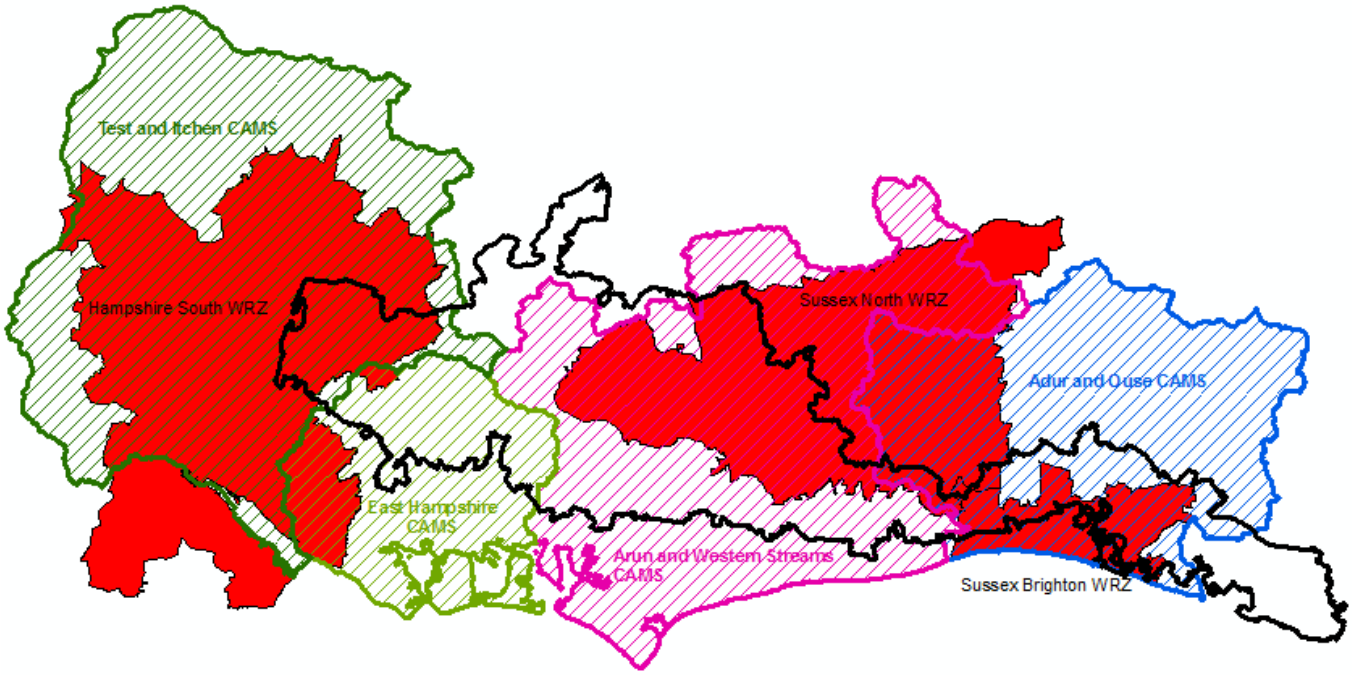
Water Co.	WRZ	SHLAA sites (Site reference)	Estimated housing yield	Baseline SDB assessment	Final planning solution	Final planning SDB assessment
South East Water	**Resource Zone 5**	EA050, EA001, EA005, EA022, EA034, EA038, EA043, EA054, EA062, EA070, EA074, EA078, EA055, EA097, EA101, CH027, CH025, EA108, EA051, EA115, EA057, EA112, EA116, CH022.	837	Declining surplus.	Further small scale (maximum 0.4Ml/d) reductions in losses from the distribution network.	Lower rate of decline and a jump in surplus at the end of the planning period.
Southern Water	**Sussex Brighton**	MI005, LE035, LE030, LE050, LE032, LE012, LE046, LE042, LE040, LE051, LE039, LE004, LE036, LE014, LE059, LE060, LE057, LE055, LE056.	821	Sustained deficit.	Nitrate management to increase deployable output, water transfers into the zone, leak reduction, and customer consumption audits to improve water efficiency and savings.	Sustained surplus.
	Sussex North	CH063, CH032, CH062, CH096, CH098, CH088, CH090, CH094, CH100, CH092, CH075, CH118, CH128, CH133, CH135 (a), CH134, Ch061, CH085, CH104, CH110, CH146, HO014, HO015.	335	Sustained deficit.	Use of treated effluent to support the resource base, nitrate management to increase deployable output, reconfiguration of resources, leak reduction, and customer consumption audits to improve water efficiency and savings.	A balance between supply and demand until 2025/26 (small deficit remains in the critical period until 2021), followed by a surplus until 2036 when this is forecast to reduce to a balanced situation.
	Hampshire South	WI004, WI020, WI005, WI034, WI035	117	Sustained deficit.	Desalination, resource augmentation, nitrate management to increase deployable output, increase water imports and reduce exports out of the zone, leak reduction, and customer consumption audits to improve water efficiency and savings.	A small surplus with a step increase in 2029 (closer to a balanced situation in the critical period). The surplus is subsequently forecast to decline over time.
Portsmouth	**Company area**	CH125, WI021, WI025, WI015, WI009, WI028, WI040.	125	Surplus.	No need for additional options but the company will provide further opportunities for bulk supplies to neighbouring water companies.	Surplus.

Water Co.	WRZ	SHLAA sites (Site reference)	Estimated housing yield	Baseline SDB assessment	Final planning solution	Final planning SDB assessment
	Total		**2235 (93% of the total 2395)**			

4.2.1 Catchment resources limiting options to secure the supply-demand balance

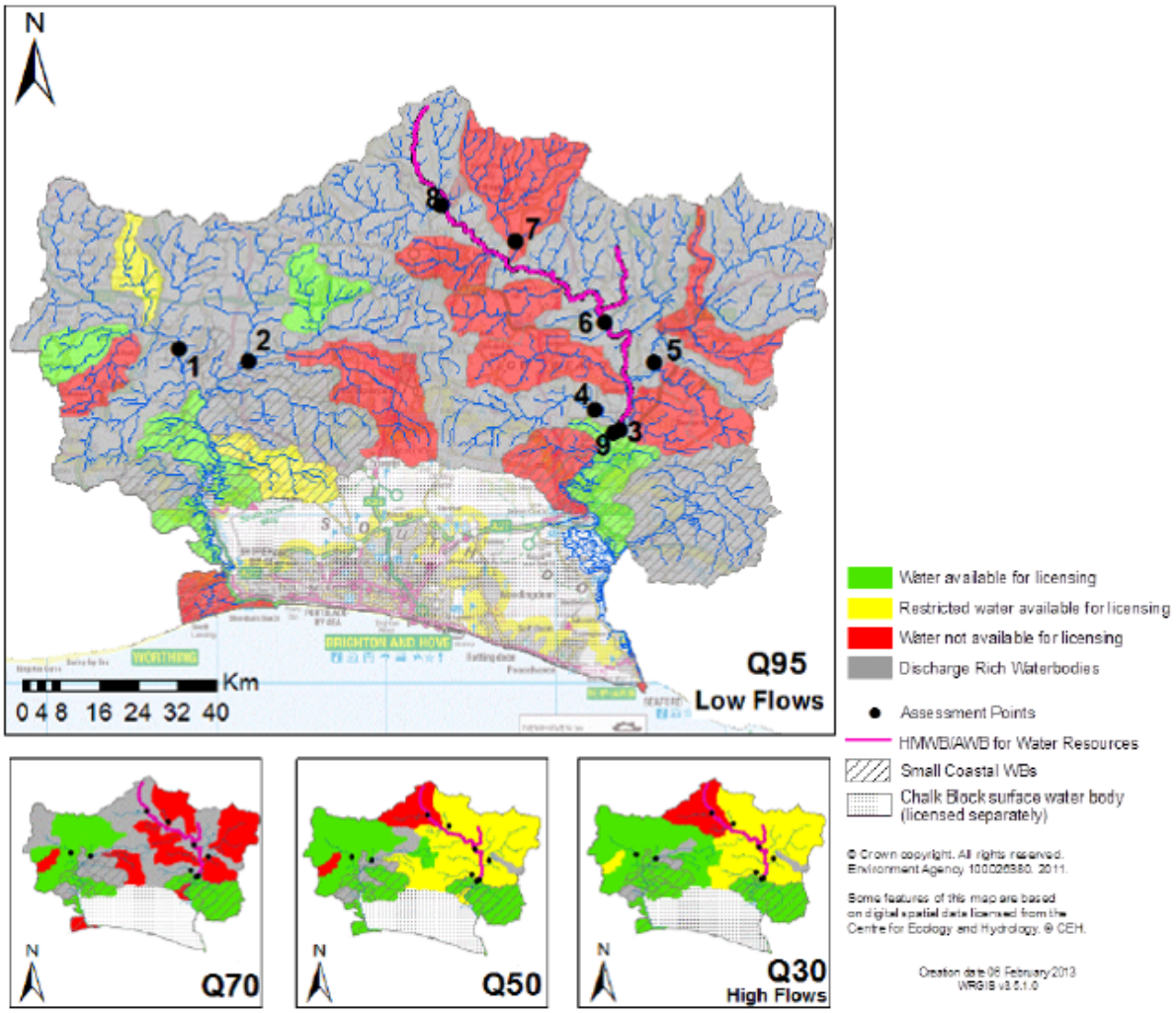
Southern Water faces considerable challenges to resolve the forecast supply deficits within the context of limited environmental water resources in the region. As identified in section 3.2.2 of the Scoping Assessment the whole of Southern Water's supply area has been classified by the Environment Agency as under serious water stress and the Catchment Abstraction Management Strategies covering the water source areas designate the catchments as over licensed or over abstracted. Figure 4.2 shows how the CAMS catchments align with the deficit water resource zones and the implications of the water resource assessments and licensing strategies on options to secure water supplies are discussed subsequently.

Figure 4.2 CAMS catchments in relation to the three deficit water resource zones relevant to South Downs



Sussex Brighton (and parts of Sussex North): Adur and Ouse Abstraction Licensing Strategy (March 2013). Figure 4.3 shows that at low flows (measured by the 95th percentile 'Q95' on the flow duration curve) most of the water units have no water available for additional licensing or the volumes that are available are restricted. In such cases flows are below the indicative flow requirement to help support Good Ecological Status (as required by the Water Framework Directive. A small number have water available. The situation improves under higher flow conditions but is still largely restricted.

Figure 4.3 Extract from the Adur and Ouse CAMS water resource availability (Sussex Brighton and Sussex North)

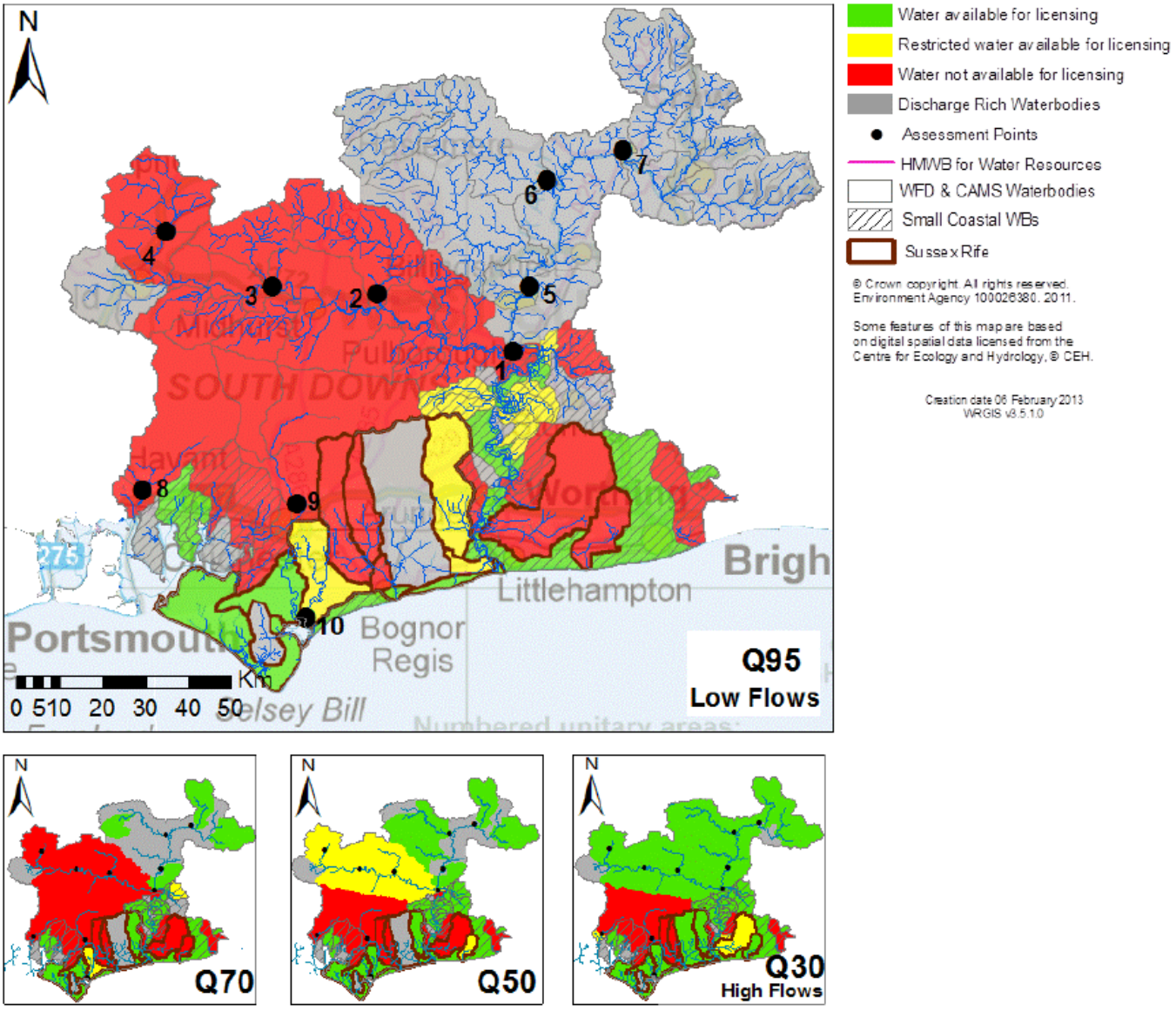


A significant contributory factor to the deficit in the Sussex Brighton zone is the impact of nitrates in water on the deployable output of existing sources. Nitrification of water is a consequence of long-term and historic land-use practice and elevated nitrate levels in water supply pose health risks to consumers. Dealing with lower concentrations of nitrate has previously been managed by blending affected sources with unaffected water, where this has been available. However, as water in the region is under increased pressure Southern Water has now included options to treat the nitrates to increase the overall volume that can be put into supply from existing sources. Transfers of water into the zone will be used to increase supply, supported by demand management measures (leak reduction and customer water audits).

Sussex North: Arun and Western Streams Abstraction Licensing Strategy (March 2013). Figure 4.4 shows that at low flows (measured by the 95th percentile 'Q95' on the flow duration curve) most of the water units have no water available for additional licensing or the volumes that are available are restricted. In such cases flows are below the indicative flow requirement to help support Good Ecological Status (as required by the Water Framework Directive.

A small number have water available. The situation improves under higher flow conditions but is still largely restricted.

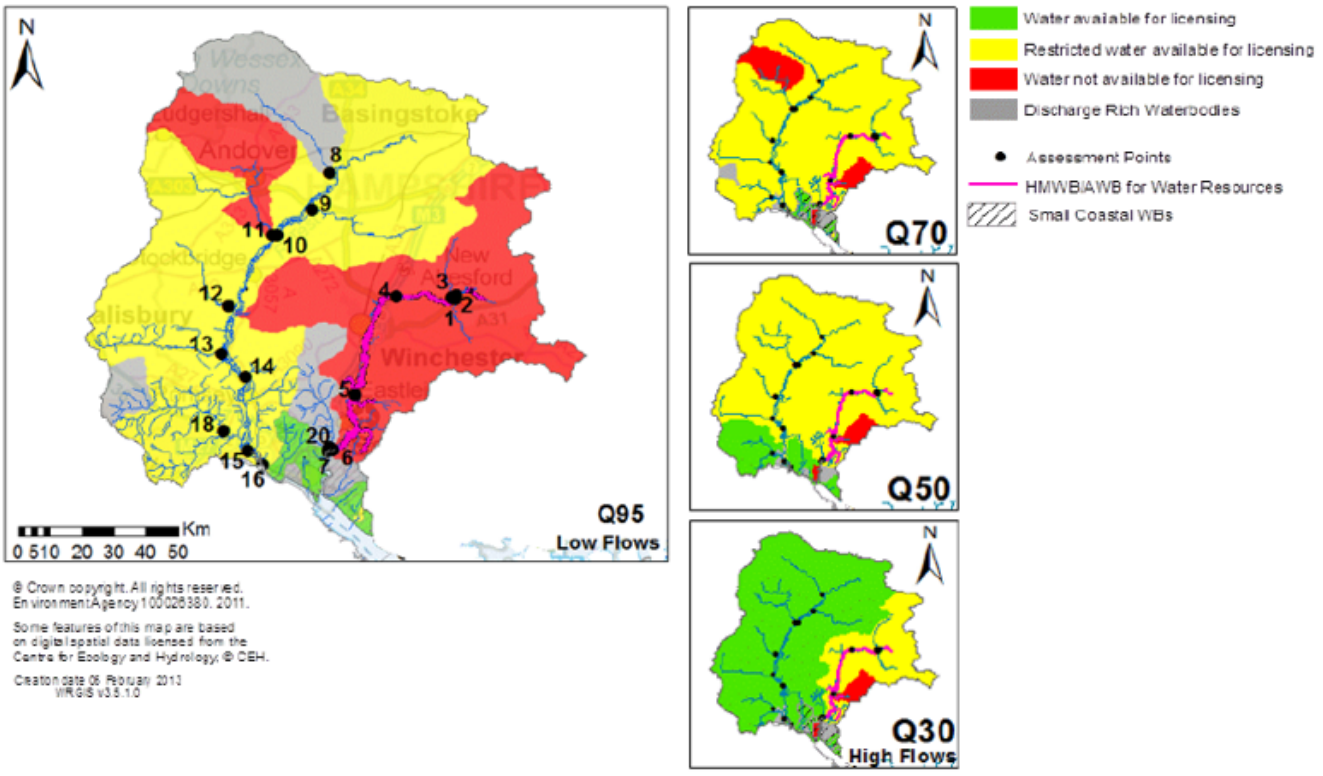
Figure 4.4 Extract from the Arun and Western Streams CAMS water resource availability (Sussex North)



The highly constrained nature of the catchment from which water is abstracted for Sussex North (excluding imports from other zones/catchments) has led Southern Water to consider and prepare an option to use treated wastewater to augment water resources in the catchment to enable further water abstractions. Nitrates are an issue across the whole region so options to treat and reduce nitrates are also part of the solution for this zone. Similarly, in a region facing serious water stress demand management options are an important part of the solution and so leak reduction and customer consumption audits are included in this zone.

Hampshire South: This zone is within the Test and Itchen, and the East Hampshire catchments. Test and Itchen Abstraction Licensing Strategy (March 2013): Figure 4.5 shows that at low flows (measured by the 95th percentile 'Q95' on the flow duration curve) water units either have no water available for additional licensing or the volumes that are available are restricted. Even under moderate flow conditions (Q70 and Q 50) water abstractions are restricted. In such cases flows are below the indicative flow requirement to help support Good Ecological Status (as required by the Water Framework Directive.

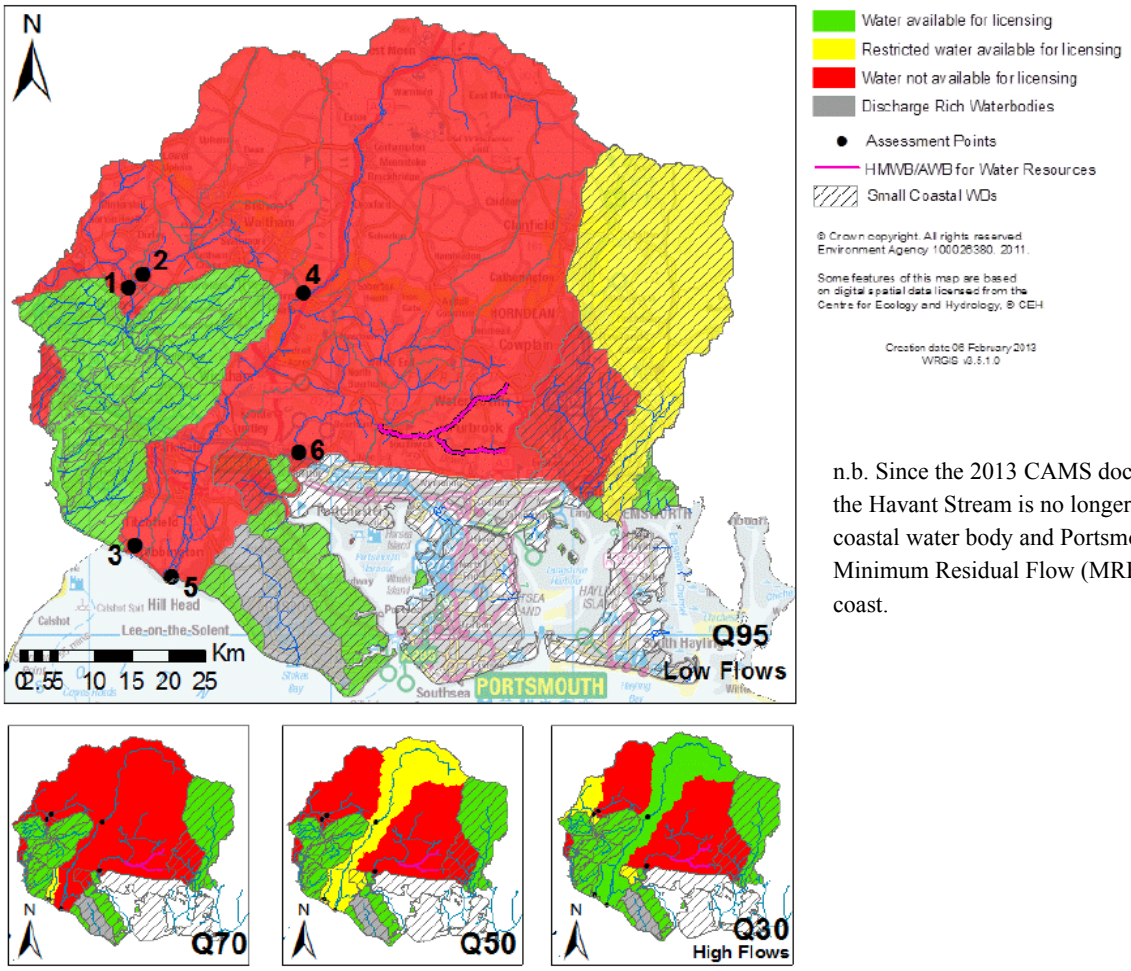
Figure 4.5 Extract from the Test and Itchen CAMS water resource availability



A large volume of resource that has previously been available within the Hampshire South zone has been confirmed by the Environment Agency as contributing to low flow conditions in the River Itchen and as such over 90Ml/d of deployable output has been removed from the supply forecast as part of the Restoring Sustainable Abstraction (RSA) programme. This is a major factor in the zone falling from a large surplus into a small but sustained deficit. Options to replace this DO with new resources are limited.

East Hampshire Abstraction Licensing Strategy (March 2013): The western part of the East Hampshire catchment that is available to Southern Water's Hampshire South water resource zone does have some water available for licensing. However, according to the Abstraction Licensing Strategy public water supply abstractions from this catchment are dominated by Portsmouth Water with abstractions also by South East Water, indicating that there is no Southern Water abstraction for public water supply from this catchment.

Figure 4.6 Extract from the East Hampshire CAMS water resource availability



n.b. Since the 2013 CAMS document was published the Havant Stream is no longer identified as a small coastal water body and Portsmouth Water has a Minimum Residual Flow (MRF) condition at the coast.

It is because of the limited options to access water resources for supply from traditional sources that has led to Southern Water selecting options such as desalination to increase supply. The company will also invest in schemes to manage and reduce the levels of nitrate in water that reduce the overall volume available to put into supply. Other options to improve the supply situation include managing the use of existing sources differently to increase overall volume, increasing the volume of water imported into the zone reducing exports. These options will be supported by leak reduction, and customer consumption audits to improve water efficiency and savings.

As a consequence of the Test and Itchen assessment the Environment Agency stated that it is "strongly supporting demand management measures such as the Code of Sustainable Homes now adopted as policy by the Partnership for Urban South Hampshire (PUSH), Southampton City Council and New Forest District Council. [We have] also supported Southern Water's universal metering programme due for completion by 2015". However, the outcomes of the Housing Standards Review which the Government is consulting on suggests that the higher levels of water efficiency are retained as 'optional regulations' in the revised Building Regulations. Similar approaches to embedding demand management within development policies in the South Downs would therefore likely be supported by the Environment Agency in the same way in relation to the level of water stress present (Chapter 6, Strategy).

It is evident from the strategies proposed by South East Water and Southern Water that demand management measures, such as leakage reduction and water efficiency measures will play a vital role in sustaining future water supply for the supply areas or these two companies.

4.2.2 South Downs development in the context of zonal development assumptions

The water company demand forecasts take account of property and population growth. All five of the resource zones in which the South Downs SHLAA development sites are concentrated include growth within the baseline forecasts. It is not possible to disaggregate the zonal development forecasts to confirm whether the precise development included within the scope of this water cycle study has been included but it is assumed that the total levels include growth for this area. One way to improve upon this assumption is to examine the information within the Water Resource Management Plans that describes the sources of data used by the water companies to develop their zonal level forecasts.

All three water companies use data collated by Experian to forecast population and property growth and the Experian data are informed by data from Local Planning Authorities. Table 4.4 reflects information from South East Water's WRMP technical report that shows after requests by Experian for growth forecasts from the Local Authorities between 59 and 74 percent of them responded with data. South East Water additionally verified the data in workshops with local authorities (although many plans were still in draft stage).

Table 4.4 Response rate from Local Authorities to requests for data for inform the population and property forecasts

Water Company	Percentage of LA responded (Phase 1)	Percentage of LA responded (Phase 2)
Portsmouth Water	67%	67%
South East Water	54%	59%
Southern Water	54%	74%

Source: South East Water/Experian (June 2013). *Population, Household and Dwelling Forecasts for WRMP14: Phase 2 Draft Final Report*.

As stated it is not possible within the scope of this study to identify South Downs growth within the overall growth levels but it is useful to compare the scale of growth within the SHLAA sites to the zonal totals as this gives an indication of the level of risk associated with this uncertainty (low, with the exception of resource zone 5 – baseline forecasts a surplus of supply – in which the South Downs development could represent around a fifth of the total for zone). Table 4.5 lists the total accepted SHLAA development sites in comparison to the total number of new builds that forecast within the water resources zones between 2015 and 2032.

Table 4.5 SHLAA developments as proportion of total new build forecast per water resource zone

Water Co.	WRZ	Estimated housing yield (SHLAA)	Total housing growth in the zone 2015-2032*	SHLAA as % of zonal total
Southern Water	**Hampshire South**	**117**	**40,640**	0.3%
	Sussex North	**335**	**13,860**	2.4%
	Sussex Worthing	45	6,330	0.7%
	Sussex Brighton	**821**	**12,310**	6.7%
South East Water	Resource Zone 2	79	15,980	0.5%
	Resource Zone 3	26	8,490	0.3%
	Resource Zone 4	10	42,550	0.02%
	Resource Zone 5	**837**	**3860**	21.7%
Portsmouth	**Company area**	125	**37,090**	0.3%

*New builds total across timescale (WRMP tables WRP2a BL Customers).

The next round of water resource management plans are due in 2019 and the companies will be re-examining population and property forecasts around 2017 and 2018. Despite the generally small level of growth in the South Downs it is good practice to support the water companies by engaging with them to provide best available growth forecasts for the longer term. Chapter 6, the Outline Strategy, includes recommendations for engaging continually over short-term development progress.

4.2.3 Per capita consumption and water neutrality

This Outline Assessment examines the baseline and final planning demand assumptions in the five water resource zones in which over 100 new homes are identified by the SHLAA data, and focuses specifically on Resource Zone 5 (declining baseline surplus), Sussex Brighton (sustained baseline deficit), and Sussex North (also has a sustained baseline deficit) where the most significant developments are planned.

Water Neutrality

The water companies point out that their Water Resource Management Plans are based on rising populations and falling pcc and that growth in new housing will in part be balanced by falling demand in existing homes. Appendix B includes illustrations of the baseline supply-demand forecasts which shows that Portsmouth Water forecasts a net decline in overall demand over time (as a consequence Portsmouth Water highlights a role for the National Park to help it promote water efficiency to people who opt to have meters installed).

However, South Downs National Park Authority has expressed explicit interest in whether it could be feasible to consider the concept of water neutrality for development in the area. This concept is therefore explained and simplistic calculations provided to enable discussion of the implications of existing demand management activities

for aspirations of water neutral development. This section focuses on the issue of neutrality as it inherently requires assessment of the per capita consumption assumptions that underpin the baseline and final planning demand forecasts.

There are many different interpretations of water neutrality and for the purpose of this water cycle study Water Neutrality uses the definition defined by Therival *et al.*[21] and applied by the Environment Agency in the 2007 Thames Gateway project[22], "*…total demand for water should be the same after new development is built, as it was before. That is, the new demand for water should be offset in the existing community by making existing homes and buildings in the area more water efficient'*. It does not take into account the detailed recommended improvements within the Environment Agency 2009 report, "Water Neutrality: An improved and expanded water resources management definition" which drills down into details including leakage and headroom and as such is beyond the scope of this assessment.

Other issues that complicate the concept of water neutrality is how far to extend the definition of the 'existing community'. This could be applied at a very local community level, a water resource zone level, a regional level, or even, arguably a national level. Water resource issues are inherently local and so any realistic attempts to consider neutrality should be within a relevant water resource locality. For the purpose of this assessment the zonal level is considered.

New demand for water will be generated by an assumed population living within new build properties. New build properties have to meet minimum standards as prescribed by the building regulations part G[23]:

Water efficiency

G2. Reasonable provision must be made by the installation of fittings and fixed appliances that use water efficiently for the prevention of undue consumption of water.

Water efficiency of new dwellings

36.—(1) The potential consumption of wholesome water by persons occupying a dwelling to which this regulation applies must not exceed 125 litres per person per day, calculated in accordance with the methodology set out in the document "The Water Efficiency Calculator for New Dwellings", published in September 2009 by the DCLG.

Table 4.6 lists the required consumption level (per capita) in new build properties. In all cases the water company measured household (combination of new and metered existing homes) under the Dry Year Annual Average planning scenario for 2015-16 exceed this. The table also contains the estimated occupancy rate of new build homes per zone

[21] Therival, R., Drury, C. and Hepburn, R., undated. *Achieving Water Neutrality in the South East Region: Discussion Paper.* Environment Agency, 2009. Water Neutrality: An improved and expanded water resources management definition

[22] Environment Agency, 2007. *Towards Water Neutrality in the Thames Gateway: Modelling Baseline, Business as Usual and Pathway Scenarios*. Environment Agency Science Report SC060100/SR1.

[23] The Building Regulations 2010. Sanitation, hot water safety, and water efficiency [http://www.planningportal.gov.uk/uploads/br/BR_PDF_AD_G_2010_V2.pdf]

(data taken from the WRMP tables) and the number of SHLAA households planned per zone. Using this information the potential new demand from the new development is estimated.

Table 4.6 New demand from housing development in the South Downs

Water Co.	WRZ	New build pcc*	New build occupancy rate*	Estimated housing yield (SHLAA)	Estimated new population	Estimated new demand (litres per day)
Southern Water	**Hampshire South**	**125**	**2.33**	**117**	**272.61**	**34,076**
	Sussex North	**125**	**2.53**	**335**	**847.55**	**105,944**
	Sussex Worthing	125	2.17	45	97.65	12,206
	Sussex Brighton	**125**	**1.92**	**821**	**1576.32**	**197,040**
South East Water	Resource Zone 2	125	2.48	79	195.92	24,490
	Resource Zone 3	125	2.33	26	60.58	7,573
	Resource Zone 4	125	2.57	10	25.7	3,213
	Resource Zone 5	**125**	**2.50**	**837**	**2092.5**	**261,563**
Portsmouth	**Company area**	125	2.17	125	**271.25**	**33,906**
Total:				2395	**5,440**	**680,010**

*Taken from WRMP tables in the Water Resource Management Plans (2015-16). Pcc from Dry Year Annual Average planning scenario.

Using this simple methodology the potential total volume of water that could need to be offset by existing customers (in this assessment demand from other water abstractors is not considered) could be approximately 680,000 litres of water per day. Applying the water neutrality concept at the water resource zone level it is then necessary to identify the existing customer base across which the water demand would need to be offset. The customer base in this assessment considers just household customers (measured and unmeasured) both of which are already subject to demand management activities which a water neutrality aspiration would need to exceed to be considered valid. In order to reflect the existing activities and demand management policies that are already in place Table 4.7 sets out the total expected measured and unmeasured population and their forecast per capita consumption levels by 2032. It is this level of per capita consumption that would need to be further reduced to offset the total South Downs development planned by 2032.

Table 4.7 Demand for water in 2032 to offset to achieve water neutrality

Water Co.	WRZ	Measured population (2032)	Average measured pcc (2032)	Unmeasured population (2032)	Average unmeasured pcc (2032)	Existing customer base demand (2032)*
Southern Water	**Hampshire South**	**65,023**	**147**	**4317**	**170**	**10,292,271**
	Sussex North	**28,348**	**148**	**1793**	**177**	**4,512,865**
	Sussex Worthing	19,139	149	1041	173	3,031,804
	Sussex Brighton	**36,582**	**137**	**3120**	**171**	**5,545,254**
South East Water	Resource Zone 2	29,887	150	2372	168	4,881,546
	Resource Zone 3	23,724	144	1853	162	3,716,442
	Resource Zone 4	67,754	150	6748	168	11,296,764
	Resource Zone 5	**11,868**	**155**	**1454**	**171**	**2,088,174**
Portsmouth	**Company area**	40,703	142	33,197	**174**	**11,556,104**
Total:						**56,921,224**

*Data from the final planning WRMP tables to reflect the impact of existing and recent policies (including metering).

Using these figures and applying a further reduction of 2 litres to both measured and unmeasured across all of the resource zones would save approximately 750,000 litres of water, more than the estimated 680,000 litres per day generated by the new population across the new build properties in South Downs. This is a very simplistic assessment which does not take into account the likely other developments within the water resource zones that could similarly claim to achieve water offsets. It may also double count the new developments within the forecast population increase, but at these contrasting scales (2395 new homes compared to approximately 150,000 existing homes) this is unlikely to have a major influence on the indicative results. There are many factors that could make it very difficult to prove that demand elsewhere had been sufficiently managed, in addition to other drivers, to specifically offset development in the South Downs.

However, this simple assessment and the significance of existing and forecast per capita consumption on total household demand for water illustrate the importance of the Local Authorities' role to support demand management in new build construction and across existing residents. More information on the role and opportunities for Local Authority Planners to influence water demand in new (and existing) homes is provided in section 6.

4.3 Wastewater treatment and water quality

This section of the Outline Assessment examines further the wastewater treatment capacity or sewerage network limitations that were identified within the scoping assessment (section 3.5). It also relates these to the SDNPA Strategic Housing and Land Availability Assessment (SHLAA) data, enabling the assessment to relate the issues more specifically to proposed development sites.

The Outline Assessment builds on the findings from the Scoping Assessment where limitations were identified, specifically examining:

- Growth proposed per WwTW catchment based on the SHLAA data;
- The limited capacity currently available at Chichester WwTW, and the timing required to deliver additional capacity at Tangmere WwTW (this issue is relevant to the large scale strategic growth outside of the National Park boundary but for which the SDNPA is responsible for planning (see section 1.2);
- The upgrades required to process the additional volumes of wastewater expected to be generated by SHLAA sites and other potential development at Tangmere WwTW and Chichester WwTW (both outside of the National Park but potentially impacted by and constraining large scale development sites that are the responsibility of SDNPA – section 1.2), Bordon WwTW, and Alton WwTW;
- The sewerage issues raised in the scoping assessment;
- The sewerage route that the wastewater from SHLAA sites and other potential developments in the Alton WwTW catchment would take to reach Alton WwTW; and
- The outcomes of the Environment Agency's investigations into the sources of phosphorous in the Tangmere and Bordon WwTW catchments.

The WwTW catchments identified as accommodating SHLAA sites do not match with those investigated in the Scoping Assessment. This is due to the difference in scale between the development sites in each study. Due to the differences in and evolution of development data between the Scoping Assessment and the Outline Assessment, the development sites have been split in to three categories for discussion purposes:

- **SHLAA sites:** sites that were identified in the Scoping Assessment and that have been accepted and are within the SHLAA list;
- **New SHLAA sites:** sites that are included on the SHLAA list but were not included in the Scoping Assessment;
- **Non-SHLAA sites:** sites that were identified in the Scoping Assessment but have not (yet) been accepted and hence are not on the SHLAA list. These sites may still be taken forward in future and hence are still given some consideration.

4.3.1 WwTW and SHLAA Data

All the SHLAA development sites have been mapped against the wastewater treatment works catchment areas (Figure 4.7). These sites include four large–scale strategic sites (100+ dwellings), 26 small scale strategic sites (20+ dwellings) and a number of smaller sites, all located within the SDNPA area.

Table 4.8 lists the WwTW catchments that have SHLAA development sites located within them, together with an indication of the associated growth that they will be required to serve. There are six SHLAA sites not included in

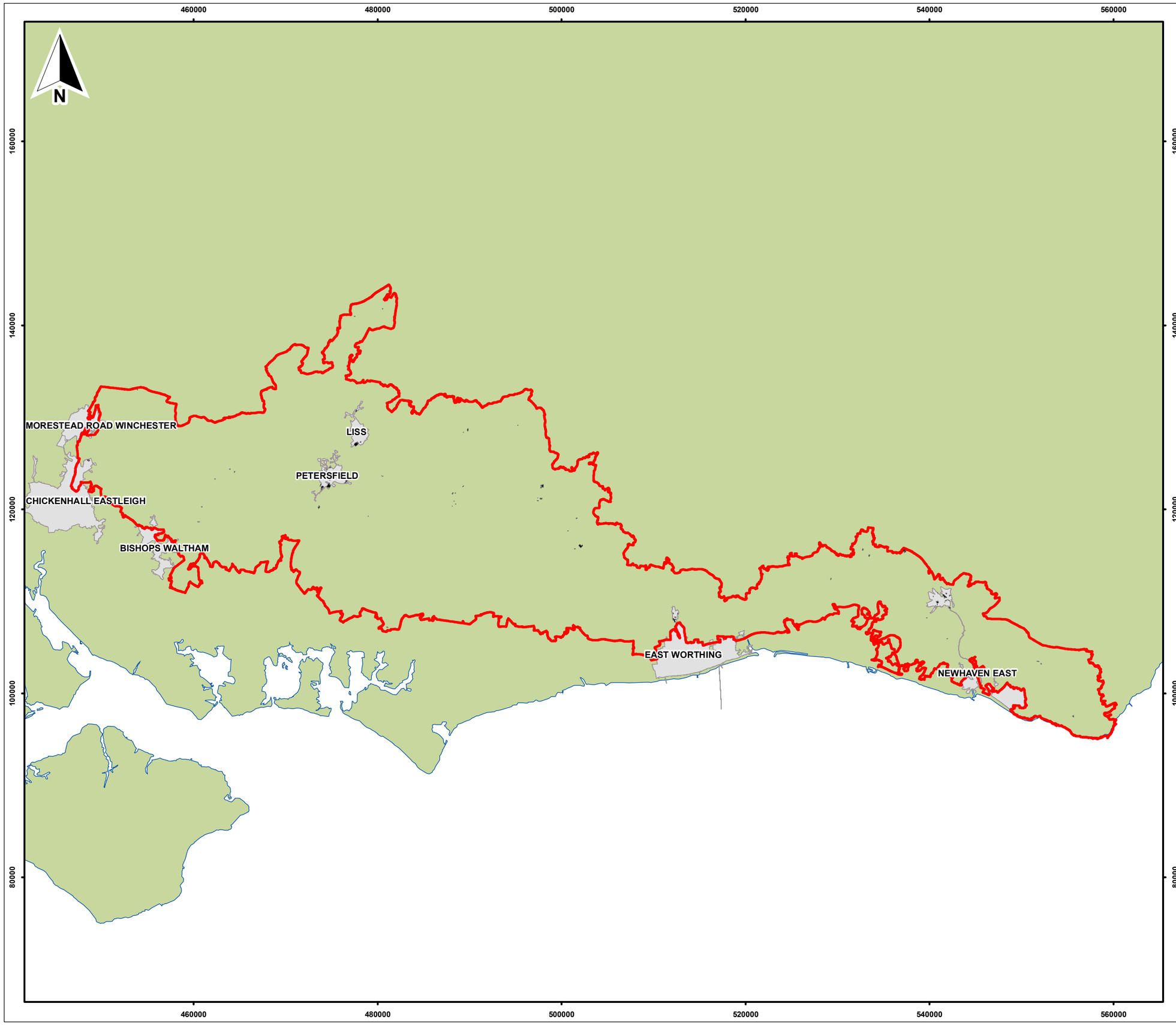
Table 4.8 (a total of 58 proposed dwellings), which are located outside WwTW catchment boundaries, and are likely to be served by cesspits. These are not considered any further within this assessment.

Table 4.8 Accepted SHLAA development sites and associated WwTWs

Water Co.	WwTW	SHLAA sites	Accepted SHLAA per WwTW catchment			
			0-5 yrs	6-10 yrs	11-15 yrs	Total
Southern Water	Alfriston	WE005, 011	6	6		12
	Bishops Waltham*	WI040		45		45
	Bosham	CH125	30			30
	Buriton	EA005	5			5
	Chickenhall Eastleigh*	WI004,005,020	64			64
	Coldwaltham	HO014, 015	25			25
	Cooksbridge	LE090	12			12
	Ditchling	LE005,016	15	30		45
	Droxford	WI025		10		10
	East Dean	WE002	14			14
	East Worthing*	AR008,010, 015,018, 020, 021	45			45
	Fernhurst	CH022, 025, 027	25			25
	Fittleworth	CH032, 135(a)	5	5		10
	Hollycroft East	LE082, 083	13			13
	Kingston Hollow	LE014	6			6
	Liss*	EA022, 034, 038, 043	155		34	189
	Morestead Road*	WI034	45			45
	Newhaven East*	LE004, 012, 030, 032, 035, 036, 039, 040, 042, 046, 050, 051, 055, 056, 057, 059, 060.	488	217	100	805
	Northchapel	CH075	8			8
	Petersfield*	EA050, 051, 054, 055, 057, 062, 070, 074, 078, 097, 108, 112, 115, 116.	404	195		599
	Petworth	CH085, 088, 090, 092, 094, 096, 098, 100, 146.	188			188
	Pyecombe East	MI005	10			10
	Rodmell	LE086	9			9
	Rogate	CH104, 110	11			11
	South Ambersham	CH061, 062, 063, 128, 133, 134	85			85
	South Harting	CH118	8			8
Thames Water	Bentley	EA001,002	19			19
Total:			**1695**	**508**	**134**	**2337****

*Assessed in the Scoping Assessment

**Less than total SHLAA figure are this excludes 58 properties located outside of WwTW catchment areas.



Key:

- South Downs NPA
- Accepted SHLAA sites
- Wastewater treament works catchment areas

0 5 10 20 Kilometers

1:400,000 @A3

H:\Projects\35227 South Downs Water Cycle Study\Drawings

South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 4.7
Accepted SHLAA Sites

December 2014
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This distribution of the SHLAA sites should be viewed alongside Figure 3. 7 and Table 3.4 from the Scoping Assessment. This is because there were additional non-SHLAA sites at Scoping that may still be taken forward for development in the future, and hence still need to be considered. Thus, the following assessment of WwTW capacity also continues take account of the issues identified within the Scoping Assessment in relation to other non-SHLAA large-scale strategic sites, in particular in the Tangmere, Chichester, Alton, and Bordon WwTW catchments.

4.3.2 WwTW capacity

The Scoping Assessment examined the capacity of WwTWs to accommodate the growth proposed at large-scale strategic development sites. This was summarised in Table 3.5. In summary, all but four of the WwTWs had the capacity to accommodate the growth identified.

Seven of the WwTW catchments listed in Table 4.8 were considered within the Scoping Assessment (denoted by a * in Table 4.8). Southern Water has confirmed that these will have capacity to accommodate the growth associated with the accepted SHLAA sites, and therefore the scoping result within Table 3.5 for these WwTWs remains valid. These seven catchments include the four large scale strategic development sites identified in Table 4.8.

Twenty of the WwTW catchments that are due to receive growth based on the SHLAA data were not assessed during the Scoping Assessment. This is because the small scale of the new SHLAA development sites in these catchments (less than 100 dwellings) meant that they were not classified as a large-scale strategic sites and hence were not included in the Scoping stage. The majority of the new SHLAA sites in these additional 20 catchments are for 5 or more dwellings, but in five of the WwTWs there is at least one new SHLAA site of 20 or more dwellings within the catchment (which constitutes a small-scale strategic site). All five WwTWs are operated by Southern Water and all have capacity to accommodate the total growth planned, as shown in Table 4.9. Due to the small size of the remaining 15 WwTW catchments (with SHLAA development sites of less than 20 dwellings) these are not considered further in this assessment.

Table 4.9 WwTW capacity for small-scale strategic SHLAA sites

Treatment works	Potential development sites	Capacity assessment
Bosham	CH125	There is capacity within the environmental Permit for the growth at these WwTWs
Coldwaltham	HO014, HO015	
Ditchling	LE005, LE016	
Petworth	CH092, CH085, CH090, CH100, CH098, CH096, CH146, CH088, CH094	
South Ambersham	CH061, CH134, CH128, CH133, CH063, CH062	

The Scoping Assessment identified no development showstoppers, but did identify that Chichester, Bordon, and Alton WwTWs all were to some degree affected in their capacity to serve the growth and thus influence phasing of growth. Further investigation of these WwTWs based on discussion with Southern Water and Thames Water

confirms that the summary of the capacity assessment provided in Table 3.5 is still valid. No new WwTWs are identified as having limited capacity for the new SHLAA sites, but Tangmere, Chichester, Bordon and Alton require further consideration to cover all future development possibilities.

Tangmere and Chichester

The Scoping Assessment identified that Tangmere and Chichester WwTWs (both operated by Southern Water) are both subject to limited capacity that would require infrastructure changes, new or amended environmental permits and further investigation (see Table 3.5) in order to accommodate the potential levels of growth. The more detailed SHLAA development plan data does not identify any accepted growth within the catchments of these WwTWs at this stage, but there are non-SHLAA sites (identified in the Scoping Assessment) in the catchment areas that could potentially still come forward for development in the future.

The need for investment within these two WwTW catchments is already established and an investment scheme that is currently in the Southern Water's Business Plan for Tangmere WwTW, would be designed and delivered in AMP6. Southern Water confirms that an investigation into the infiltration issue [24] at Chichester WwTW is still ongoing, and that the capacity in the catchment therefore continues to be limited. However the planned upgrades at Tangmere WwTW offer a solution to this limited capacity until the extent of/solution to the infiltration issue is known. Development on the outskirts of Chichester City (west, north and east), which currently falls into the Chichester WwTW catchment could be diverted to Tangmere WwTW. The anticipated delivery date of additional capacity at Tangmere WTW is 2019. Southern Water has also confirmed that the type of scheme/investment that will be undertaken will be dependent on the planned housing numbers within the Local Plan. Southern Water confirms that sites A16, B06 and B07 (non-SHLAA strategic sites identified within the scoping study) are all expected to drain to Tangmere WwTW, and the combined 2500 dwellings from these sites are being taken into account in Southern Water's planning. It is estimated that the scheme will be in place by 2019.

The capacity assessment in Table 3.5 is still valid for Chichester and Tangmere WwTWs, which concluded that any significant levels of development within either of these catchments would need to tie in with completion of the investment scheme at Tangmere WwTW.

Bordon and Alton

The Scoping Assessment identified that both Bordon and Alton WwTWs (both operated by Thames Water) currently have capacity to accommodate some growth plans, with only minor investment needed. Proposed growth to the maximum (i.e. the 'worst case' scenario in the Scoping Assessment) would require substantial upgrades. The more detailed SHLAA development plan data does not identify any accepted growth within the catchments of these WwTWs at this stage, but it is still possible that non-SHLAA sites (identified in the Scoping Assessment) could be developed in the catchment in future.

Thames Water has indicated that it will *"deliver STW [WwTW] upgrades when there is certainty that development will be coming forward which isn't the case at the moment"*. The nature of the upgrade work will be dependent on

[24] The Chichester WwTW catchment experiences groundwater infiltration, which limits the available capacity at the works.

the levels of committed growth, with infrastructure being put in place for use in the subsequent AMP Period. Therefore the nature of upgrading is likely to be a number of smaller upgrades when required rather than one significant investment. Any proposed development within Alton and Bordon WwTWs will need to be planned to fit in with completion of infrastructure upgrades. The results in Table 3.5 of the scoping study still remain valid.

4.3.3 WFD Objectives on options to increase capacity

The Scoping Assessment summarised the water quality situation of the receiving waters associated with four WwTWs for which permit changes may be required to accommodate large-scale strategic sites (Table 3.6). In summary, WFD objectives were to reach Good Status/Potential in all receiving waters by 2027, following further investigation into the sources and measures required to achieve this. For the receiving waters of Tangmere and Bordon WwTWs, elevated phosphorus levels were evident, although the source was unknown. The source of pressures identified in Chichester WwTW (Dissolved Inorganic Nitrogen levels) and Alton WwTW (biological elements) receiving waters were also unknown. These four receiving waters are examined further. No other wastewater treatment works' catchments contain strategic growth sites in the SHLAA dataset and as defined in section 1.7.2 this puts them outside of the scope of this study.

Table 4.10 provides further clarity on the outcomes of the Environment Agency's investigations to date for the receiving waters of the four relevant WwTWs. These investigations and any further studies will support the second round of WFD River Basin Management Plans, and include identification of sources of unsatisfactory water quality levels, as well as cost benefit analysis to support identification of the key measures for each watercourse.

Table 4.10 WFD investigations into water issues [*Pers. Comms., Environment Agency, October 2014*]

WwTW	Investigation	Impact on growth Plans
Tangmere WwTW Aldingbourne Rife	Cost benefit analysis demonstrated that it will not be cost beneficial to deliver schemes that would achieve good status in the Aldingbourne Rife. Modelling confirmed that increasing the WwTW treatment standards, including introducing a Phosphorus limit, will allow future development to be accommodated at this WwTW. **However, information provided by Portsmouth Water suggests the waterbody status may have deteriorated to Bad status since the latest publication of data.** The scheme submitted by Southern Water in their Business plan is intended to maintain the status of the Aldingbourne Rife (as Moderate). **Further investigation may be required to confirm the actual status of this water body and the impact of the new scheme to be implemented by Southern Water.**	Investment scheme planned will likely take account of requirements such as introducing a phosphorus limit, and will ensure no deterioration in class while also accommodating growth plans.
Chichester WwTW Chichester Harbour, a coastal waterbody	Chichester WwTW contributes to high nitrogen levels seen within the Chichester Harbour (partly due to infiltration issues). The WwTW already has nutrient removal to best available technology, therefore the only improvement would be through diversion of the	Growth beyond the small available headroom, it is considered that impacts on the harbour will be too great. Tangmere will accommodate planned growth within Chichester.

	WwTW discharge offshore. Associated costs of this magnitude are very unlikely to be cost beneficial.	
Bordon WwTW River Wey (southern)	No investigations have specifically looked into within the receiving waters for Bordon WwTW. Improvements to the Bordon Wastewater Treatment Works have been included in the list of measures required to achieve WFD objectives. These will be based around the current permitted capacity.	No change to impacts identified in Table 3.6
Alton WwTW Caker Stream, part of the River Wey catchment	No investigations have specifically looked into within the receiving waters for Bordon WwTW. However the Environment Agency confirms that improvements to the WwTW has been included in the list of measures required to achieve WFD objectives. These will be based around the current permitted capacity.	Alton WwTW may be subject to tighter quality consents, or additional structural changes to the works to meet the requirements of WFD prior to 2027.

In summary, Table 4.10 reflects a change to the Scoping Assessment of Tangmere and Alton WwTWs. While no further investigation has been undertaken for Alton WwTW receiving water, the Environment Agency states that this WwTW may be subject to tighter permits or structural changes to meet WFD requirements. The upgrade at Tangmere WwTW will ensure Aldingbourne Rife does not deteriorate from its current class but will plan to accommodate the 2500 dwellings of the strategic sites identified within the Scoping Assessment.

4.3.4 Sewerage Capacity

This section reviews the sewerage issues raised in the Scoping Assessment and comments in relation to the SHLAA sites. The potential need for further capacity has been discussed with Southern Water and Thames Water, who provided the following responses:

- Southern Water identify that *"In principle there are few locations where there is significant spare capacity in the sewerage system because we look to provide capacity in parallel with development. It would not be appropriate to provide significant headroom unless there is certainty that the development will come forward and the headroom will be utilised (rather than left to stand idle). We look to Local Plans to set out the location and scale of development in order to facilitate investment planning. We will also engage at planning application stage to bring forward the necessary infrastructure in a timely manner, in collaboration with the planning authority and developers"* [Pers. Comms., Southern Water];

- Southern Water would likely need to model the impact on the sewerage system in order to determine whether capacity is available for the individual SHLAA sites. This usually occurs when site options have been refined and published in a draft Local Plan. This will inform the planning authority and planning policies so that delivery of necessary infrastructure is supported by the Local Plan; and

- Thames Water identify that while the scale of an individual development is unlikely to have a significant impact on the existing network, the developer will be required to provide information in support of planning applications that shows capacity exists or it can be provided ahead of occupation, in some circumstances this may require the developer to fund an impact study [*Pers. Comms., Thames Water*].

Both Southern Water and Thames Water will provide the necessary sewerage capacity in parallel with the development of the individual sites, in collaboration with developers and the planning authority. The exact location and scale of upgrades will be determined once there is more certainty of the development size, location and phasing.

It continues to be the case for the SHLAA sites that sewerage will not pose an absolute barrier to growth but upgrades will need to be planned in time for house occupation.

Chichester and Tangmere

The Scoping Assessment identified that development provides the opportunity to access and upgrade sewer infrastructure rather than adding to the pressure, and that sewerage capacity will be provided in parallel with the housing development.

With upgrades to Tangmere WwTW already being taken forward to accommodate capacity issues within Tangmere and Chichester WwTW catchments, Southern Water have confirmed that the sewerage network for non-SHLAA strategic sites A16, B06 and B07 (in the Scoping Assessment) would need to be put in place to convey all the sewerage to Tangmere WwTW. This would be designed and developed as part of the individual developments [*Pers. Comms., Southern Water]*. In the case of Site B07 this may require more substantial upgrade and investment work to connect a larger distance to the existing Tangmere sewerage network.

Bordon and Alton

The Scoping Assessment identified that there would be limited sewerage network capacity to serve the three identified proposed (non-SHLAA) developments; D03, B08 and C06 and that local upgrades are anticipated for both the associated WwTWs Bordon and Alton. It notes that the sewerage network and SPS (Sewer Pumping Station) can accommodate the current housing within the Bordon WwTW catchment. Sewerage upgrades are likely to be required to support further growth. Appropriate phasing of development will be required along with developer-funded detailed drainage strategies to identify what network upgrades are required ahead of occupation [*Pers. Comms., Thames Water]*.

The sewerage network in and around Alton is known to be complex. Discussions with Thames Water confirm that Holybourne, Caker Stream Road, and Newmans Lane SPS all convey sewerage to Alton WwTW independently. Holybourne SPS serves the area of Holybourne, located north of Alton. Caker Stream Road SPS serves the local area around Caker Road, and local industrial estates. SDNPA confirms that strategic site C06 is the total of all strategic sites across Alton itself, not one large site. Therefore to understand the ability of the local sewerage network to accommodate strategic sites, assessments will be required on the individual planning applications and the exact location and scale will be determined once certainty of development location, size and phasing are known [*Pers. Comms., Thames Water*].

4.3.5 Conclusions and Recommendations

This Outline WCS has identified that there is generally capacity in the existing water infrastructure to accommodate growth, but limitations exist in terms of phasing development with upgrades. It is advised that SDNPA, Thames Water, Southern Water and the Environment Agency liaise closely to consider growth numbers, wastewater demands, and the impact of environmental objectives on environmental permits and the level of treatment that will be required at WwTWs.

Planned investment at Tangmere WwTW will enable accommodation of planned growth in this area and that of Chichester WwTW, which are both outside the National Park. If other developments were to come forward over and above those identified within the scoping study then further upgrade may need to be considered, however this will be dependent on the timescales of these additional developments coming forward. Upgrades are planned based on development numbers identified within the local plans.

Once further investigations into the infiltration issue at Chichester WwTW are complete and a solution is identified this may enable an increase capacity at this WwTW. However timescales for this are unknown.

Bordon and Alton WwTWs both have capacity for small amounts of growth, however based on current housing plans there are no upgrades planned at either WwTW. As planned developments are taken forward it is likely that these WwTWs will require future upgrade, possibly during AMP 7. Therefore phasing of growth plans would be important. These two WwTWs may also be subject to tighter quality permits or structural changes to meet the requirements of WFD,

Sewerage infrastructure is provided by both water companies as individual sites come forward, and the individual planning applications are often supported by studies to clarify the available capacity or connection requirements. Therefore it is important that occupation of developments ties in with completion of these upgrades, but will not prevent the development from occurring.

Southern Water confirmed that the phasing requirements for new development in the Tangmere and Chichester WwTW catchments that is currently planned (i.e. set out in the Chichester draft Local Plan) is fully understood. Further study could be undertaken for Alton and Bordon WwTWs to understand the phasing requirements of planned growth to fit in with required upgrades.

5. Flood Risk

5.1 Baseline flood risk characterisation

The baseline flood risk characterisation has been completed as part of the overall Scoping Assessment as a precursor to the Level 1 SFRA which follows. It reviews the various sources of flood risk across the study area. This section identifies these various sources and illustrates their magnitude and how they are distributed across the study area. The Outline Assessment reviews the potential future developments within the study against this baseline; flood risk information key areas and issues are identified.

Relevant flood risk information is located within numerous studies (specific document details are listed in Appendix C):

- **Catchment Flood Management Plans (CFMPs):** published by the Environment Agency in 2009, these assess how flood risks (fluvial, surface water, groundwater and tidal[25]) are distributed within individual river basins. River catchments are sub-divided into sub-areas each of which receives a classification which sets out which of six national policies on future flood risk management activities are relevant. There are seven CFMPs across the SDNP study area;

- **Strategic Flood Risk Assessments (SFRAs):** published between 2007 and 2012, these were prepared by, and assess flood risk within, the local authority areas (district, borough, and unitary). The studies assess the risk of flooding from all sources with specific reference to the authority's future development plans. There are ten SFRAs across the SDNP study area;

- **Shoreline Management Plans (SMPs):** published in 2006, these studies assess the risk of erosion and flooding to the coastal frontage. The plans are developed by Coastal Groups on a regional basis and include representatives from councils and government agencies. Only a small length of coastline near Eastbourne is directly relevant to the study area and this area is covered by two SMPs; and

- **Preliminary Flood Risk Assessments (PFRAs):** published in 2011, these studies assess the level of current and future flood risk facing each Lead Local Flood Authority (LLFA). Four LLFAs/PFRAs cover the SDNP study area.

A range of locality specific studies are also available, including:

- Surface Water Management Plans (SWMPs), and Integrated Urban Drainage Studies prepared for Brighton and Hove, and Lewes respectively. These studies provide a focussed assessment on the specific sources and pathways leading to flooding at these locations;

[25] Coastal flood/erosion risk is considered within the SMPs, the CFMPs focus on inland areas where flood risk is tidally influenced.

- Tidal Strategies prepared for the River Arun, Adur, and Cuckmere Haven. These assess the most appropriate management option for the tidal reaches of these rivers, specifically focussing on the best use of available resources to protect people, property, infrastructure, and designated wildlife habitats from flooding, whilst working with natural processes to manage the impacts of rising sea-levels.

Overall these studies take into consideration all sources of flood risk, historical information, the effects of flood defences, and changes likely due to the effects of climate change. In addition to reviewing the studies identified above, this baseline flood risk characterisation is informed by flood risk information provided by the Environment Agency. Figures 5.2 to 5.4 illustrate how fluvial/tidal flood risk and surface water flood risks are distributed across the study area.

Gaps identified in this baseline flood risk characterisation are listed in section 5.1.9. The Level 1 SFRA in the Outline Assessment is consistent with the current policies detailed in these studies.

Seven sources of flooding have been identified within the SDNP study area:

- Fluvial – from the various watercourses and tributaries across the study area (Rivers Itchen, Meon, Rother, Arun, Adur, Ouse, and the Cuckmere River) both defended and undefended;
- Tidal – along the lower Rivers Arun, Adur, Ouse, and the Cuckmere River (flood defences are present);
- Surface water –where rainfall accumulates quicker than it can infiltrate into the ground and/or be conveyed away by local drainage (man-made and natural systems) flooding can occur. The information suggests multiple areas are at risk across the study area;
- Groundwater –the extensive chalk geology across the study area makes groundwater a key issue. The information suggests multiple areas are at risk across the study area;
- Sewer flooding (foul and surface water) –occurs when the capacity of the sewer systems is exceeded. Specific data is not available from the water companies but general risks are outlined in relation to the SHLAA data in the Outline Assessment; and
- Tidelocking – Tides can affect water levels in drainage pipes as well as natural water courses. High tides only pose a risk to drainage pipes if they occur at the same as high rainfall (when the water volume in the drains is already high). Inter-tidal areas on rivers interact with the tide without issue as this is the normal situation. There are greater risks for rivers which discharge through tidal sluices. This issue is examined further within the Level 1 SFRA;
- Artificial sources – structural failures of flood defences, reservoirs, and other artificial water infrastructure can create acute flood risks.

5.1.1 Flood zones

Flood Zones are terms used to describe a series of fluvial and coastal flood extent datasets produced by the Environment Agency. The Level 1 SFRA (section 5.2) uses this terminology. The Environment Agency defines four categories of Flood Zone:

- **Flood Zone 1:** Land least at risk of flooding: assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (>0.1 percent); and
- **Flood Zone 2:** Land assessed as having between 1 in 100 and 1 in 1000 annual probability of river flooding (1 percent - 0.1 percent); or between 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5 percent - 0.1 percent) in any year.

The NPPF subdivides Flood Zone 3 into Zone 3a and 3b and defines these individually:

- **Flood Zone 3a:** Land most at risk of flooding: assessed as having a 1 in 100 or greater annual probability of river flooding (1 percent) or a 1 in 200 or greater annual probability of flooding from the sea (> 0.5 percent) in any year;
- **Flood Zone 3b:** Land specifically designated to store flood water or allow water to flow in times of flood. SFRAs are required to identify this Flood Zone taking into account local circumstances. Land which would flood with an annual probability 1 in 20 (5 percent) can be considered and discussed as a starting point to identify land that could be allocated as the functional flood plain. Data at the Scoping Assessment does not disaggregate between 3a and 3b. This is examined in more detail in the Level 1 SFRA.

5.1.2 Fluvial flooding

The Environment Agency has recognised the challenges faced by local communities in SDNP as a result of the risk of flooding and has developed seven Catchment Flood Management Plans (CFMPs) to provide the overall strategy for managing fluvial flood risk. The distribution and spatial scope of CFMPs are shown on Figure 5.1 and Figure 5.2 shows the Environment Agency's Flood Zone 2 and 3 maps.

The level of flood risk for each of the proposed large-scale development sites in the study is listed together with a summary of the risks from all other sources of flooding at the end of this section in Table 5.1.

There are corridors of flood risk along the main watercourses and tributaries of: Rivers Itchen, Meon, Rother, Arun, Adur, Ouse and the Cuckmere River. Within the study area, the CFMPs flag the following settlements as being of **notable risk** from fluvial flooding:

- River Meon: Corhampton, Meonstoke, Warnford, Exton, West Meon, East Meon, and Frogmore;
- Hambledon Stream: CFMP notes potential Flood Alleviation Scheme (FAS) for Hambledon;

- River Rother: Petersfield and Midhurst;
- River Ouse: through Lewes including the Cockshut Stream, the winterbourne and the Glynde reach.

The detail of the key flood risks identified by the CFMPs and the consequent policies to manage fluvial flood risk identified by the Environment Agency are summarised in Tables C.1, C.2 and C.3 (Appendix C).

Relevant flood risk information has also been obtained by reviewing the ten SFRAs produced by the Local Planning Authority's and the four Lead Local Flood Authority's (LLFAs) PFRAs which cover the SDNP study area (details of these SFRAs and the results are summarised in Appendix C, Tables C.4, C.5 and C.7). The SFRAs provide further detail on watercourse not picked up in the CFMPs, and indicate that flood risk is also an issue along some of the smaller watercourses, such as the River Hamble, the Hambledon Stream, the River Wallington, the upper Lavant Stream, the Rivers Ems, Lavant, and the Upper Alderbourne Rife, and the Upper and the Ferring Rife.

The reviewed reports indicate that groundwater influence on fluvial flooding is a problem along the Rivers Itchen, Meon, Lavant, as well as some of the smaller tributaries. In these areas fluvial flooding is often caused by high groundwater levels reaching the surface (a product of prolonged periods of above average rainfall), rather than as a direct a result of individual heavy rainfall events. The Findon valley above Worthing is also highlighted as having experienced fluvial flooding, associated with groundwater emergence.

Over the eastern portion of the study area, the main rivers (Rother/Arun/Adur/Ouse/Cuckmere) are less groundwater dominated, and more responsive to short-term rainfall (more 'flashy') owing to the less permeable geology underlying large areas of their catchments. Petersfield, one of the two main towns within the National Park is located alongside the River Rother and there have been various historic works to reduce the risk from watercourses within the town have been flood risk management has been historic works to watercourses within the town.

Figure 5.3 shows the historic fluvial flood extents. This highlights flooding along the River Itchen (upstream of Winchester), the River Meon, the Oakhanger Stream, the River Arun above Arundel, and along the River Ouse (Lewes), and along the Cuckmere River. Records of historic flood events highlight previous flood incidents at:

- River Itchen: Bramdean, Cheriton, Owlesbury and Twyford;
- River Hamble: Upham, Lower Upham;
- River Meon: Corhampton, Meonstoke, Soberton, Warnford, Exton, West Meon, East Meon, and Frogmore;
- River Wey (Oakhanger Stream): Selbourne and Shortheath;
- Lavant Stream: Chalton, Finchdean, Rowlands Castle;
- River Rother: Petersfield and Sheet;
- River Arun: Amberley Station, Burpham, and Offham; and

- Cuckmere River: Alfriston, Litlington, and West Dean.

Flood incidents in villages along the valley bottom of the River Itchen are associated with high groundwater levels supporting high and sustained flows in local springs and water courses. This problem is often exacerbated by constrictions in the local drainage network, for example in winterbourne areas the connectivity or conveyance capacity of the overall local drainage network may be limited. In particular pipes, culverts and bridge apertures may cause localised 'pinch-points' through limited design capacity or through having become silted or blocked during the intervening dry periods.

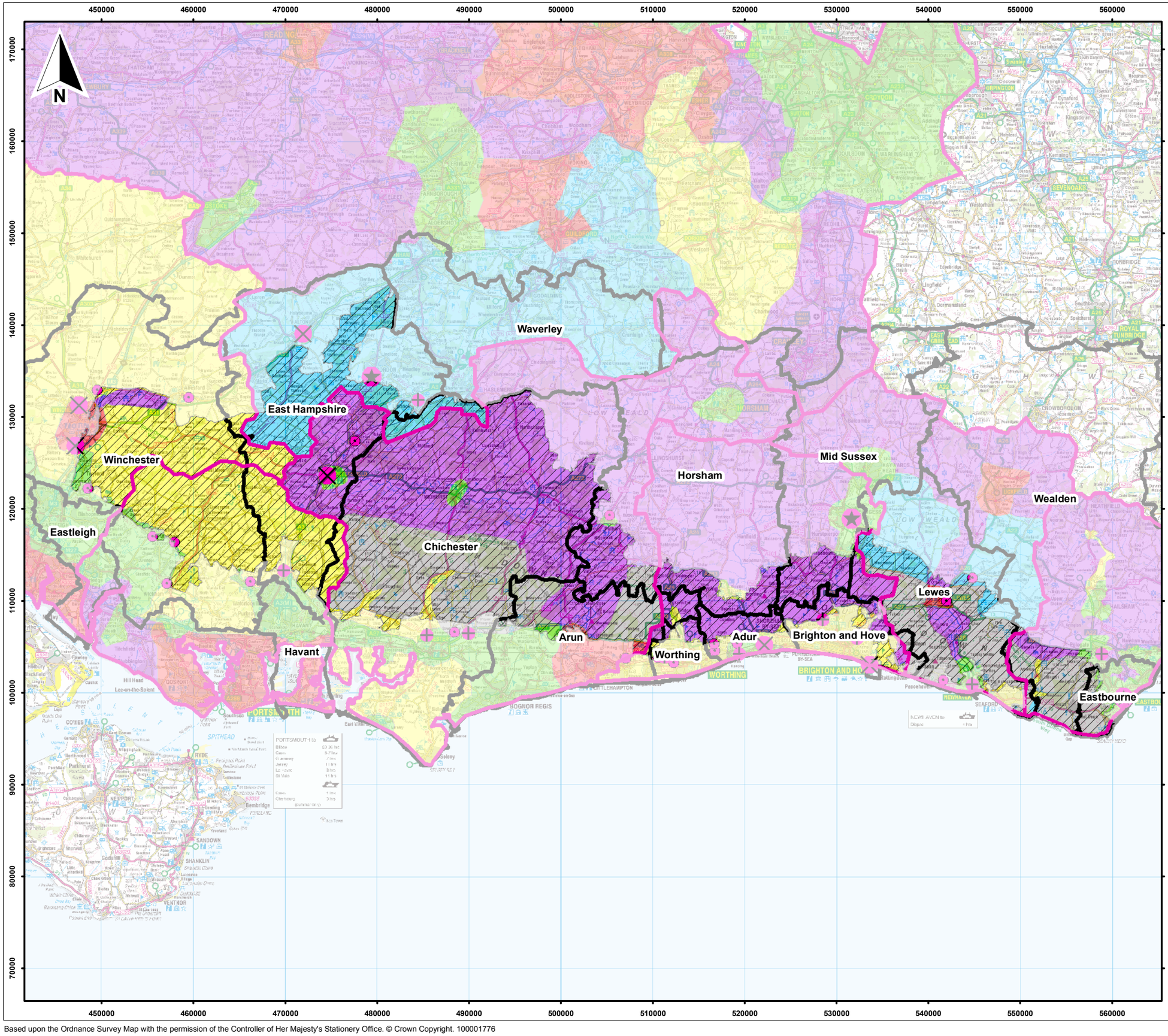
The Environment Agency undertakes the role of Internal Drainage Board (IDB) for the lower Rivers Arun, Adur, Ouse, and the Cuckmere River. These areas are served by a series of defences to manage tidal/fluvial flood risk along these watercourses. In some areas additional pumping is provided to remove surface water from the embanked floodplain areas. Whilst a degree of maintenance to existing flood defences and pumping stations in rural areas will be undertaken in the short term, in the longer term this role will cease, with the Environment Agency seeking to stop its overall level of intervention. In this context the Environment Agency provided the following statement:

"The Department for the Environment, Food and Rural Affairs (Defra) feels it is important that responsibility for managing local watercourses more appropriately sits with local bodies, including local authorities, which are best placed to take decisions on local priorities in discussion with their communities. Defra is keen to enable such bodies, and individuals such as riparian owners, to act effectively to achieve the outcomes the communities want to see. Therefore, in line with government policy, we are seeking to transfer the management of ordinary watercourses within the Sussex IDDs to local ownership. To do this, we must abolish the existing IDDs. Although work on ordinary watercourses will cease to be the responsibility of the Environment Agency, the work may still need to be carried out."

The changes will result in increased utilisation of the available floodplain storage. The remaining ongoing intervention by the Environment Agency will be focused on protecting the key settlements in these areas. The respective adaptation Strategies prepared for these watercourses (summaries and references are provided in section 5.1.3) detail the preferred course of action in future years. The majority of the watercourses within the study area have no formal flood defences present. Flood defences exist along the tidally influenced reaches of the following watercourses:

- River Arun: defended by embankments from Pulborough, through the study area to the coast). The IDB role is now managed by the Environment Agency. There are some issues associated with conveying floodplain flows into the river (it is a pumped system), although only a limited number of properties are at risk;
- River Adur: defended by embankments through the study area to the coast;
- River Ouse: defended by embankments through the study area, and at Lewes in particular; and
- Cuckmere River: through the study area to the coast.

Through the study area, the defences are typically earth embankments providing a Standard of Protection (SoP) of around 3.33 percent Annual Exceedance Probability (AEP) in rural areas, with localised areas of up to 1 percent and 0.5 percent AEP protection adjacent to the main settlements (Arundel and Lewes). In places such as Cuckmere Haven, the defences have suffered from erosion and storm damage in recent years.



Key:

- CFMP areas
- SDNPA boundary
- Local Authority boundary

Major Developments within 2km

- 100 - 500
- 500 - 1000
- 1000 - 3000
- 3000+

Policy Areas

- Policy 1
- Policy 2
- Policy 3
- Policy 4
- Policy 5
- Policy 6

0 20,000 Metres

Scale: 1:400,000 @ A3

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South Downs National Park Authority Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.1
Catchment Flood Management Pland (CFMPs)

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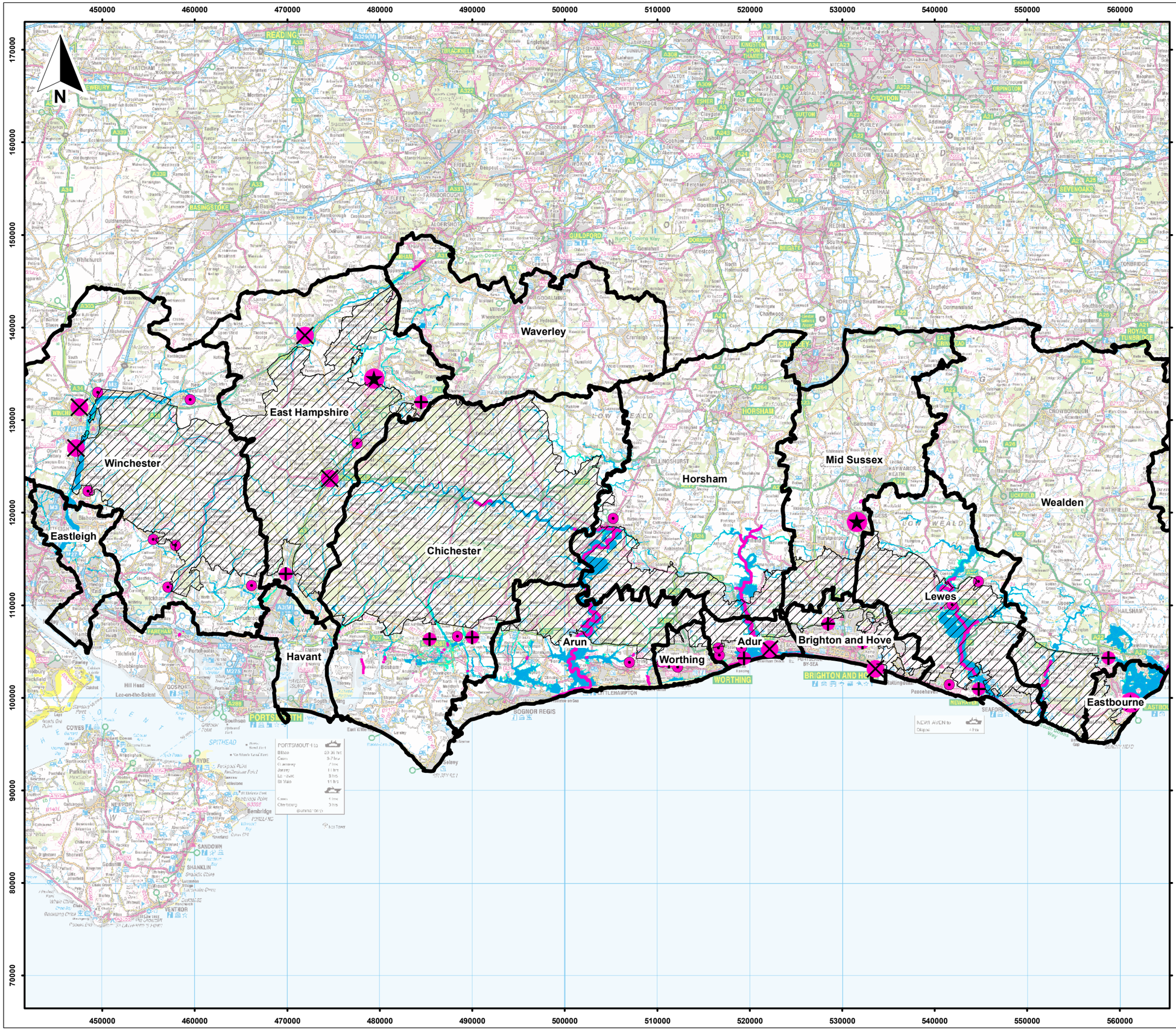

Key:

- SDNPA boundary
- Local Authority boundaries
- Floodmap defence
- National floodzone 3
- National floodzone 2

Major Developments within 2km

- 100 - 500
- 500 - 1000
- 1000 - 3000
- 3000+

0 20,000 Metres

Scale: 1:400,000 @ A3

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Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.2
Fluvial Flood Risk - Environment Agency Flood Zone 3 and Flood Zone2

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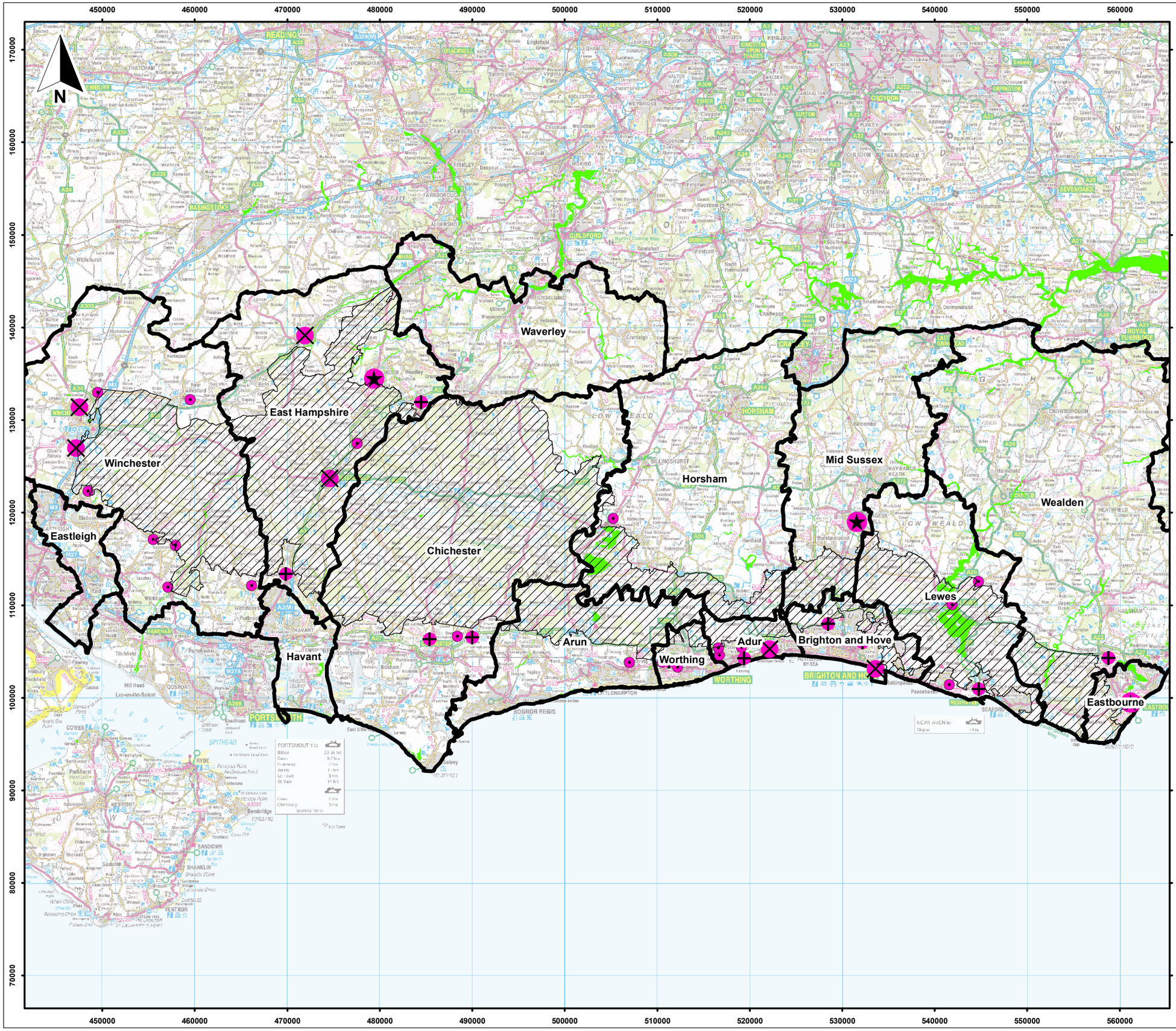

Key:

- SDNPA boundary
- Local Authority boundary
- National historic flood map

Major Developments within 2km

- 100 - 500
- 500 - 1000
- 1000 - 3000
- 3000+

0 20,000 Metres

Scale: 1:400,000 @ A3

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Figure 5.3
Fluvial Flood Risk - Environment Agency Historic Flood Map

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5.1.3 Tidal Flooding

Tidal flood risk extends inland along the Rivers Arun, Adur, Ouse, and along the Cuckmere River (Figure 5.4). A series of flood defences (generally low earth embankments) run alongside these rivers, protecting adjacent low-lying areas. In rural areas the defences have a typical Standard of Protection (SoP) of 1 in 30 years (Adur and Worthing SFRA (2012), Arun SFRA (2008), Lewes SFRA (2009), and Wealden and Eastbourne SFRA (2008)). The Environment Agency's National Flood and Coastal Defence Database (NFCDD) contains further details of the defences. Agriculture dominates land use in the areas alongside these water courses and so the risk from tidal flooding to existing development is generally limited. The exception to this is Lewes which is subject to by tidal flood risk because of its location on the tidal River Ouse. Smaller settlements along the Cuckmere River (West Dean, Litlington, and Alfriston) are also affected by tidelocking as well as the A259 Bridge at Exceat.

Considering these proposed strategic development locations, tidal flood risk could potentially pose the biggest risk to future development at Lewes and Newhaven on the River Ouse, and Shoreham/Lancing adjacent to the River Adur. Overall based on the strategic information on future development locations, the majority of locations are set away from the study area's four main tidal rivers and the short section of coastline. The parts of the study area at greatest tidal flood risk are generally rural in nature, with strategic development being directed to locations in the study area at low risk of tidal flooding. The overall intention of the strategies is to protect existing population centres, and in less populated areas to take opportunities to reduce management interventions. New flood defence infrastructure is proposed at Newhaven and Shoreham to manage tidal flood risk. For potential future development proposed near tidally influenced rivers such as the Adur and Ouse (Lancing and Lewes respectively), strategic developments will need to be bought forward in consultation with the relevant risk management authorities, since the current strategies do not extend into this part of the SDNP study area. A review of the supporting strategies and plans is provided below.

Coastal and Tidal Plans and Strategies

A range of policy documents have been developed to plan for and manage coastal change and flood and erosion risk. Sections of the SDNP area between Brighton Marina and Eastbourne follow the coastline. The future management of these sections has been assessed within two Shoreline Management Plans (SMPs) (see Appendix C, Table C.7). SMPs are produced by 'coastal consortia', and include a range of stakeholders, including the Environment Agency and local authorities. The SMPs identify the agreed policy to be taken forward in managing each section of coast against erosion. The SMPs have three broad policies: 'No Active Intervention' (NAI), 'Managed Realignment' (MR), and 'Hold the Line' (HTL). Figure 5.4 shows the distribution of these policy units. Along the chalk cliffs between Seaford and Eastbourne, the policy is NAI in the short/medium/long term. Whilst the chalk cliffs will continue to erode, this will have no impact on tidal flood risk (as there are no flood risk receptors). A policy of NAI has been adopted for Cuckmere Haven. Potentially, this could change the level of tidal flood risk along the Cuckmere between the coast and Exceat. Whilst initially NAI is being followed at the mouth of the River Ouse at Newhaven, a policy of MR has been identified for the medium and long term. This could influence tidal flood risk inland, within the study area. The SMPs identify the policy to HTL at the mouth of the Adur and Arun in the short/medium/long term.

The CFMPs (Appendix C) identify that the following **fluvial flood risk** strategies should be developed:

- **Lower Tidal River Arun Strategy (consulted 2012):** this strategy makes a range of recommendations to change the Environment Agency's management of the flood defences along the Arun. Within the study area, the following changes are proposed:

  - Pallingham to River Rother confluence: withdraw existing but limited maintenance to natural river channel (in formal flood defences at this location) involving removal of debris/trees upstream of bridges. A slight local increase in flood risk is expected (within floodplain areas important for providing floodplain storage);

  - River Rother confluence to River Stor confluence: within a period to be agreed with landowners, it is proposed to stop maintaining flood defences (anticipated to be between 2014 and 2016), and at the end of their life stop operating the existing pumping station and masonry wall;

  - River Stor confluence to Houghton: 'Arun Valley' nature conservation site. There are to be no immediate changes but all future 'management' options propose to allow flood risk to increase within floodplain areas important for providing floodplain storage. Over the next ten years the Environment Agency will work out the best management option in light of the legal protection given to this SPA/SAC/Ramsar site;

  - Houghton to Arundel: within a period to be agreed with local landowners it is proposed to stop maintaining flood defences between 2014 and 2016 and the tidal influence will increase; and

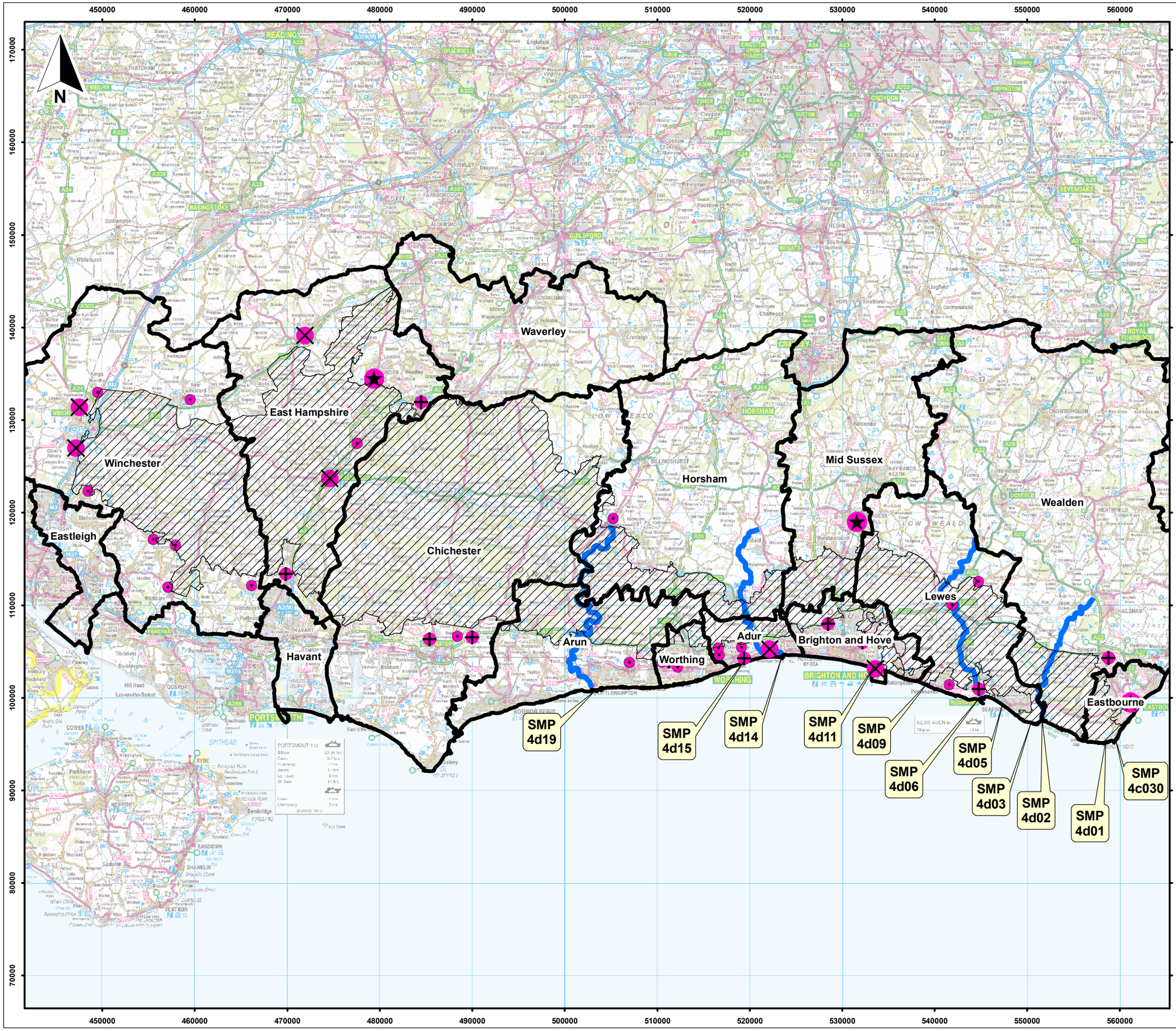
  - Arundel Town Centre (edge of SDNP): sustain (in line with climate change) current level of protection provided by flood defences (around 1 in 75 year) is to be maintained into the future.

- There are two strategies detailing future actions along the River Adur. The **Adur Tidal Walls Strategy** was developed to enhance and protect Shoreham via the construction of new flood defences. The **Tidal Adur Strategy** is currently on hold, when undertaken this will take a similar approach to the LTRAS study on the Arun. CFMP context is to remove defences where possible and work with natural processes, suggesting that as for the River Arun this could be the future policy for the section situated in the SDNP;

- The **River Ouse Strategy** (approved May 2012): this includes three separate schemes to manage tidal flood risk at Newhaven. The study does not extend inland into the study area;

- **The Cuckmere Estuary Flood Risk Management Strategy (2008)** defines the future policy as: 'Decreasing Investment through an Exit Strategy leading to a controlled transition to 'No Active Intervention' over 20 years. This policy was implemented by the EA in 2011, and involves the controlled reduction in intervention to manage impacts on assets at risk (blockages at the mouth of the Cuckmere, the A259 Exceat Bridge, and public footpaths). Currently shingle is cleared from the mouth of the Cuckmere twice a year. A fully tidal estuarine system will ultimately develop. Whilst the Cuckmere River remains tidally influenced upstream of the A259 to Alfriston, the strategy intends that the potential impacts on this river reach will be managed by the 'Decreasing Investment' to NAI Exit

Strategy. Defences protecting built up areas will continue to be maintained, whilst opportunities to set defences back in other areas will be appraised.



Key:

- SDNPA boundary
- Local Authority boundary
- Tidally influenced river

Major Developments within 2km

- 100 - 500
- 500 - 1000
- 1000 - 3000
- 3000+

SMP 4d19 — Shoreline Managment Plan (SMP) reach reference

0 — 20,000 Metres

Scale: 1:400,000 @ A3

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Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.4
Tidal Flood Risk

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5.1.4 Surface water flooding and drainage

The Environment Agency's Surface Water flood risk maps[26] (Figure 5.5) indicate that large areas within the study area are within the areas identified as being susceptible to surface water flooding. At the SFRA stage, no distinction has been made between the three surface water risk classifications (High risk: 3.33 percent AEP, Medium risk: 1 percent AEP and Low risk: 0.1 percent AEP). The overall extent of risk at each potential future development location has been used to inform an assessment of the relative degree of surface water flood risk at each location, providing a strategic ranking of the potential development locations suitable for the SFRA. A more detailed assessment will need to be made on a site-by site basis, when more detailed topographic and development master planning information will be available. The SFRA provides recommendations for a range of measures to be applied in future when individual sites come forward for development, such as the use of green corridors along known flow pathways/low spots or undertaking additional modelling to clarify and manage the risk.

The assessment in the SFRA is primarily based on the Environment Agency surface water flood risk mapping, supplemented by information obtained on known hotspots from existing PFRAs and SFRAs. Areas of risk typically follow the main watercourses, and further upstream/upslope tend to extend across areas of depressed topography, such as the winterbourne/dry valleys into the chalk downland areas. Surface water flooding can happen rapidly, in normally 'dry' areas away from watercourses. This makes it more difficult to forecast (compared to tidal or fluvial flooding) which can make it particularly disruptive. Surface water flooding occurs where accumulated rainfall exceeds the ground's infiltration capacity, or the capacity of the drainage system (piped or watercourses). Water then accumulates, flows overland, and forms pools in low lying areas.

Flood waters from field runoff and along highway/urban corridors in valley bottoms usually have a high sediment content, increasing the negative impacts of the flood. This occurs across the study area and this is confirmed in the various CFMPs, SFRAs and PFRAs (Appendix C). The Level 1 SFRA emphasises the significant influence of the CFMPs and SFRAs on improving farm planning and land management to reduce the potential for 'muddy' runoff from adjacent arable land into developed areas. There are also problems with surface water drainage/tidelocking at Alfriston and West Dean. The flood risk documents make multiple references to run off from upper catchments (within the SDNP area) affecting adjacent areas such as: Worthing/Findon/North Lancing/Shoreham/Brighton and Hove. There have been historical incidents of surface water flooding along the chalk escarpment at Pyecombe, Poynings and Fulking in the upper River Adur, as well as along the Rivers Itchen/Meon/Hamble.

Historic experience indicates that surface water flooding has occurred frequently within parts of the study area underlain by relatively permeable chalk geology. It is not though clear-cut whether the historic records simply highlight areas that have experienced rainfall events capable of generating this type of flooding, whilst other areas shown to be at risk have no historic records. Alternatively, the differences between surface water conveyance in the dry valleys may be caused by differences in soil types and/or the type of agriculture practised on the land. Multiple historic records mention 'muddy floods', suggesting that runoff from areas under arable agriculture (in comparison to grassland areas) is particularly important in generating surface water flooding events. However, agricultural practices change through time, so the presence of records (or lack thereof), does not necessarily assist in identifying

[26] The SFRA utilises the latest available surface water flood risk dataset, this being the updated Flood Map for Surface Water (uFMfSW) mapping released by the Environment Agency in March 2013.

future risk. For this reason, where flow paths are shown developments should incorporate design and layout measures to manage the risk.

The risk of surface water flooding for each of the proposed large-scale development sites is listed, together with all forms of flood risk, at the end of this section in Table 5.1.

These issues and the implications for development are examined further in the Level 1 SFRA (section 5.2)

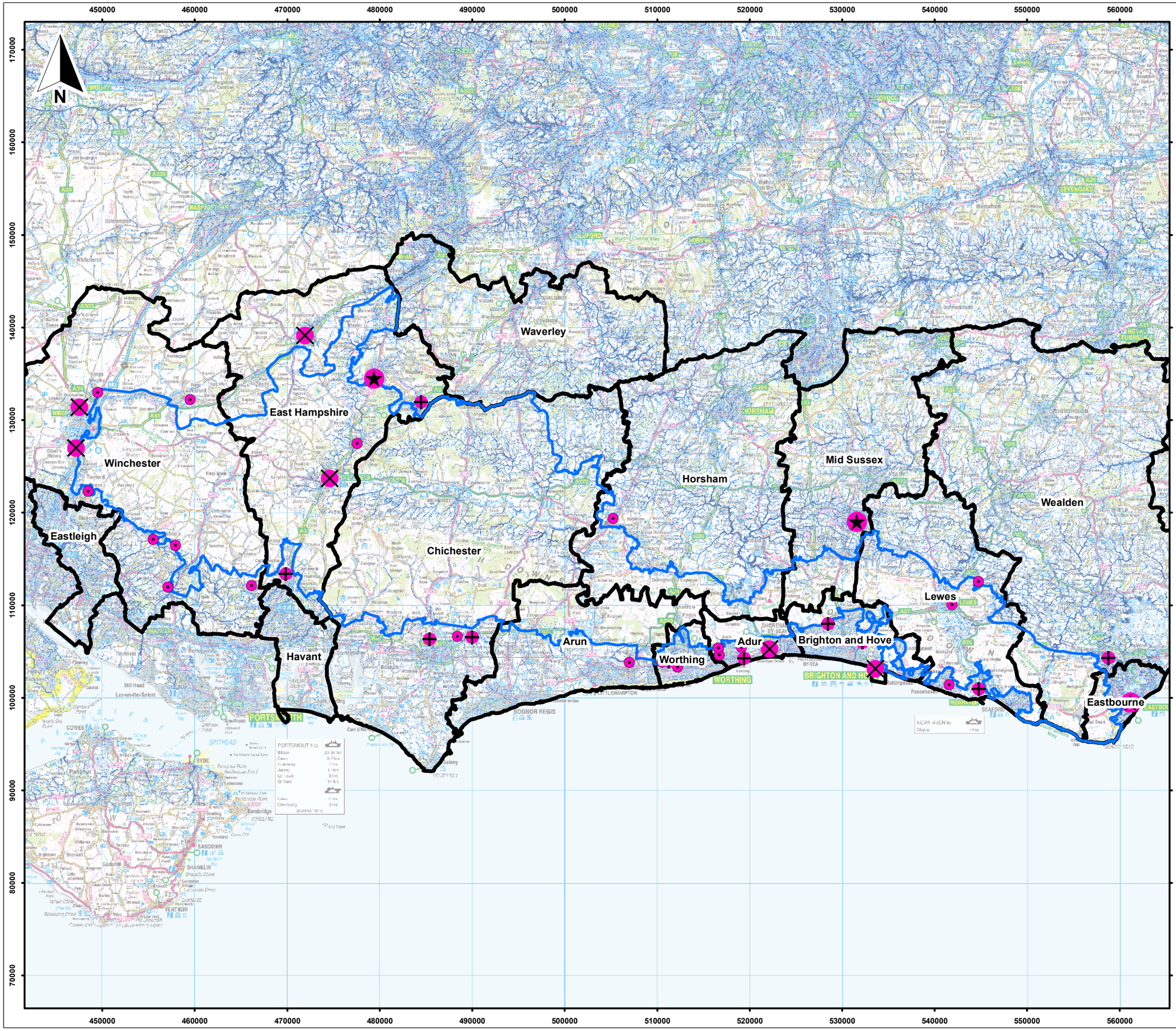
Status of surface water management plans

The CFMPs (Appendix C, Table C.1/C.2/C.3) recommended four distinct Surface Water Management Plans (SWMPs) to tackle **surface water flood risks**. The status of each of these is given here:

- Brighton and Hove –SWMP (2013): Out of 42 areas examined seven are highlighted and five are relevant to the SDNP:
  - 1) Mile Oak, 2) Bevendean, and 3) Ovingdean (Ketts Ridge) experience problems of surface water runoff (plus some groundwater influence) from adjacent hillsides within the SDNP area;
  - Issues at 4) Patcham, and 5) Moulescombe Primary School/Lewes Road are caused by groundwater emergence;
- Petersfield: to date no SWMP has been developed;
- Lewes: A detailed 'Integrated Urban Drainage' (IUD) study[27] was prepared in 2008 which examined the in-combination effect of multiple sources of flooding in Lewes. Figure 17 of the IUD (Volume 2) details the locations of historic flooding incidents (predominantly the 2000 event). In Lewes there are complicated interactions between exceedance of piped systems' capacity, groundwater emergence, and tidelocking of the minor watercourses/piped systems where they join the River Ouse. A range of recommendations were made to improve the existing systems, with specific reference to key development areas in Lewes. As LLFA East Sussex County Council continues to progress the actions within the Lewes SWMP; and
- Alfriston/West Dean: To date no SWMP has been developed;

The Local Flood Risk Management Strategies (LFRMS) prepared by the four LLFAs details various surface water/drainage issues by individual localities, and detail a range of investigations and potential measures to be implemented.

[27] http://archive.defra.gov.uk/environment/flooding/documents/manage/surfacewater/lewesappend.pdf



Key:

- SDNPA boundary
- Local Authority boundaries

Major Developments within 2km

- 100 - 500
- 500 - 1000
- 1000 - 3000
- 3000+

Risk of Flooding from Surface Water

- High
- Medium
- Low

0 20,000 Metres

Scale: 1:400,000 @ A3

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Figure 5.5
Surface Water Flood Risk

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5.1.5 Groundwater flooding

Groundwater flooding is a major source of flood risk across the study area, mainly associated with the extensive chalk geology beneath the SDNP. Long periods of sustained rainfall can elevate groundwater levels, which emerge at the surface at topographical low points, such as 'dry valleys' and the foot of the chalk escarpment. Due to the buffering effect of the chalk, groundwater flooding can seem slow to respond to rainfall events, but once it starts flooding can be sustained for a period of months until groundwater levels subside. For this reason groundwater flooding is particularly disruptive. The bedrock which influences the nature of groundwater flooding across the study area is shown in Figure 5.6 and the extent of the superficial geology types is shown in Figure 5.7.

Groundwater flooding can occur via aquifers situated both in the bedrock and superficial geology. In addition, the superficial geology may influence where groundwater from the bedrock geology reaches the surface. The surface water flood map in the previous section (Figure 5.5) provides an approximate guide to the 'dry valleys' where groundwater can emerge when groundwater levels are high. A range of dry valleys are highlighted across the chalk downland. As well as in these winterbournes, groundwater flooding may occur along the valley bottom and valley sides of the main river valleys as they pass over the chalk. For this reason historic flood events are often classified in terms of a single flood source, despite having fluvial, surface water, and/or groundwater elements.

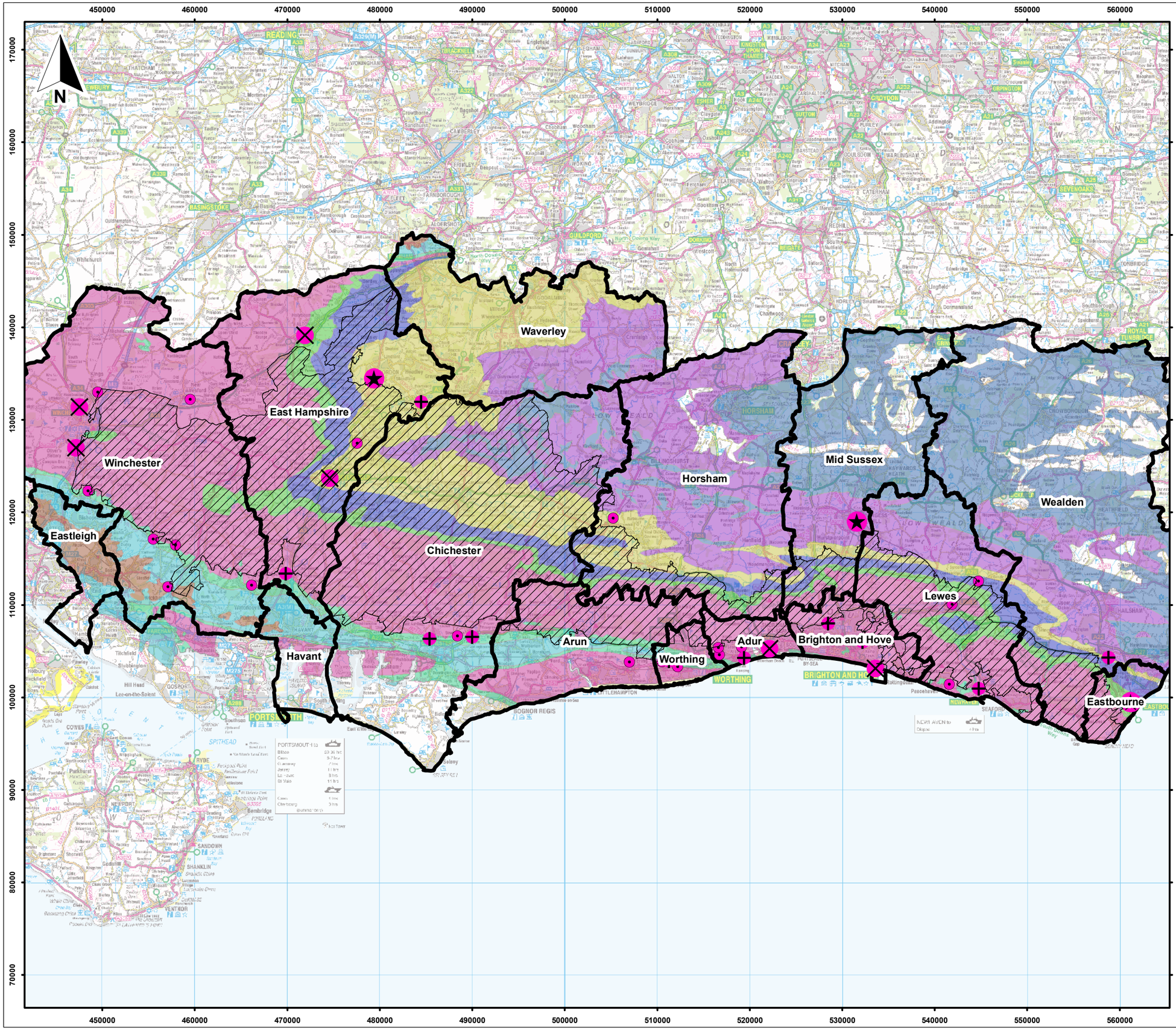
The level of groundwater risk for each of the proposed large-scale development sites in the study is listed together with all forms of flood risk, at the end of this section in Table 5.1.

Information on groundwater flooding is taken from the various CFMPs (Appendix C) which have identified several areas which are particularly at risk: Hambledon (Hambledon Stream); settlements along the River Meon; chalk streams emerging along the A27 near Chichester; the River Lavant; Lewes; areas within Brighton and Hove; and along the Cuckmere River at Alfriston, East Dean, and West Dean.

The SFRAs and PFRAs (summarised in Appendix C) confirm that a large number of settlements have experienced groundwater flooding. Tables C.4, C.5, C.7 and C.8 list the settlements along the Rivers Itchen, Meon, Hamble, Hambledon Stream, Lavant Stream, the River Lavant, the upper River Rother at Liss/above Petersfield, where various incidents have occurred as a result of groundwater emerging in 'dry valley's within the Brighton and Hove area. Many of these areas were affected by the serious groundwater flooding that occurred across the study area in winter 2014.

The LLFA Hampshire County Council has prepared a Groundwater Management Plan [28] which includes specific flood risk management plans for the Finchdean, Hambledon, Rowlands Castle, and West Meon areas. These plans are important for the local management of groundwater flood risk, and provide additional supporting information for these localities.

[28] http://www3.hants.gov.uk/flooding/hampshireflooding/surfacewatermanagement/groundwater.htm



Key:

- SDNPA boundary
- Local Authority boundary

Major Developments within 2km

- 100 - 500
- 500 - 1000
- 1000 - 3000
- 3000+

Bedrock Geology

- Bracklesham group and barton group (undifferentiated) - sand, silt and clay
- Gault formation and upper greensand formation (undifferentiated) - mudstone, sandstone and limestone
- Grey chalk subgroup – chalk
- Lambeth group - clay, silt, sand and gravel
- Lower greensand group - sandstone and mudstone
- Thames group - clay, silt, sand and gravel
- Wealden group - mudstone, siltstone and sandstone
- Wealden group - sandstone and siltstone, interbedded
- White chalk subgroup - chalk

0 20,000 Metres

Scale: 1:400,000 @ A3

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Figure 5.6
Bedrock Geology

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Waverley
East Hampshire
Winchester
Eastleigh
Chichester
Havant
Horsham
Mid Sussex
Wealden
Lewes
Arun
Adur
Worthing
Brighton and Hove
Eastbourne

Key:

- SDNPA boundary
- Local Authority boundary

Major Developments within 2km

- 100 - 500
- 500 - 1000
- 1000 - 3000
- 3000+

Superficial Geology

- Alluvium
- Brickearth
- Clay-with-flints
- Lacustrine deposits (undifferentiated)
- River terrace deposits (undifferentiated)
- Sand and gravel of uncertain age and origin

0 20,000 Metres

Scale: 1:400,000 @ A3

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Figure 5.7
Superficial Geology

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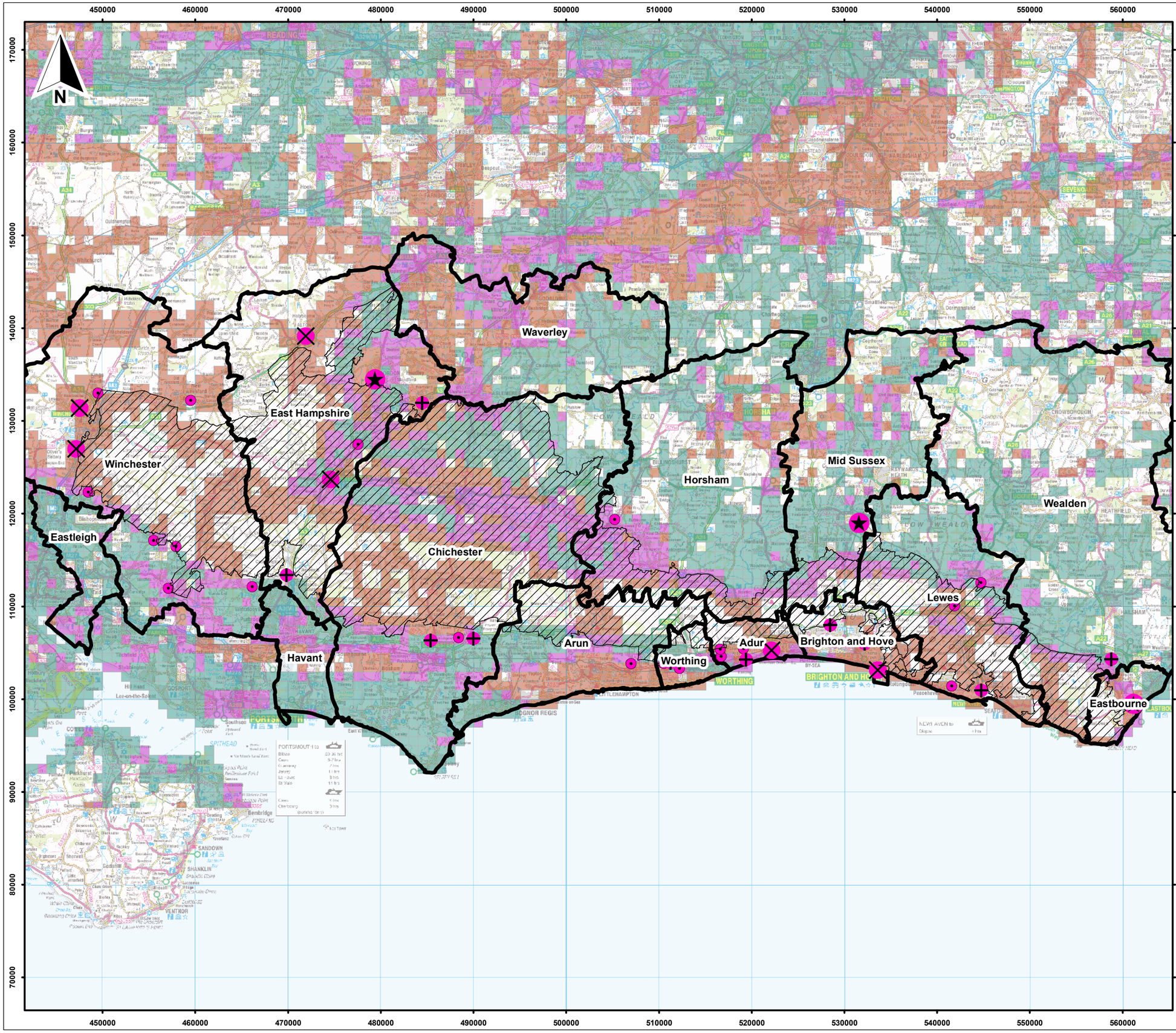

Key:

- SDNPA boundary

Major Developments within 2km

- 100 - 500
- 500 - 1000
- 1000 - 3000
- 3000+
- Local Authority boundary

Flood Type

- Clearwater
- Clearwater and superficial deposits flooding
- Superficial deposits flooding

0 20,000 Metres

Scale: 1:400,000 @ A3

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Figure 5.8
Groundwater Flood Risk

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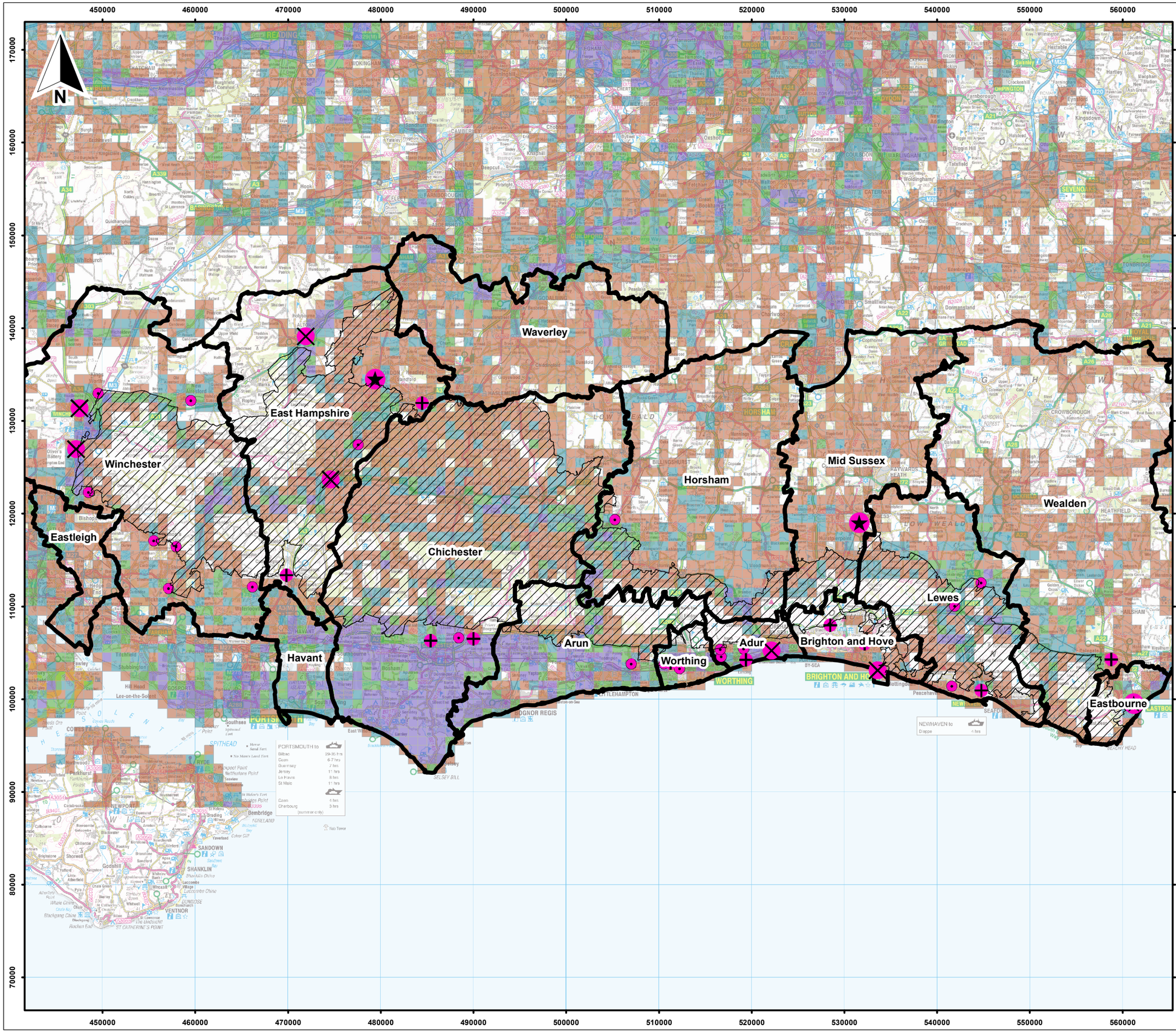

Key:

- SDNPA boundary

Major Developments within 2km

- 100 - 500
- 500 - 1000
- 1000 - 3000
- 3000+
- Local Authority boundary

Class

- < 25%
- >= 25% <50%
- >= 50% <75%
- >= 75%

0 20,000 Metres

Scale: 1:400,000 @ A3

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South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.9
Groundwater Flood Risk

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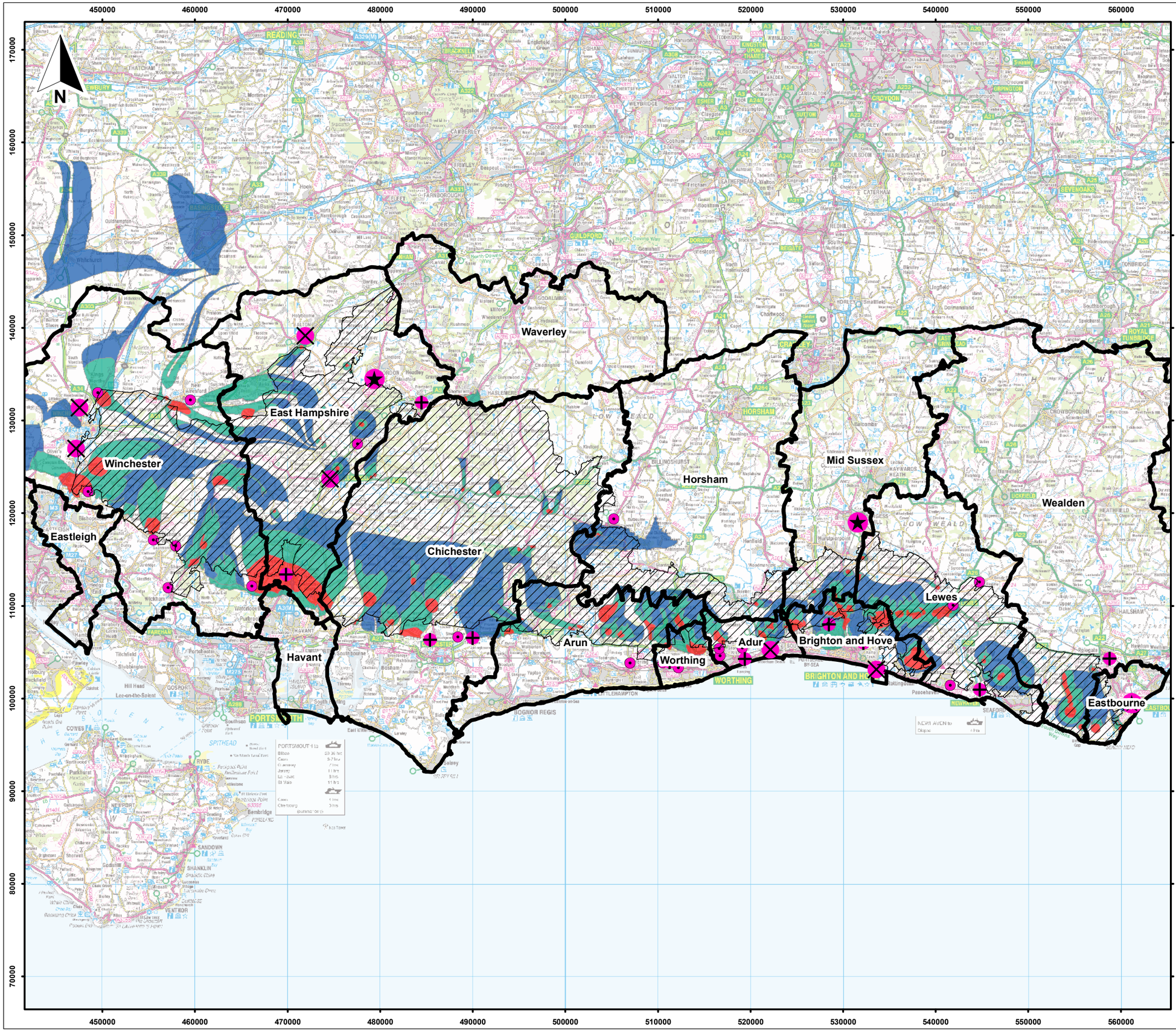
Sustainable Urban Drainage Systems (SuDS)

The management of runoff from developments is a requirement of the NPPF. A range of SuDS options are available to provide source-control, infiltration and attenuation of runoff, in order to limit rates to pre-development levels. SuDS also have the additional benefit of providing enhanced water quality compared to traditional piped systems (settling of silt/debris, bio-treatment of some contaminants). Hydrocarbon interceptors should also be included in drainage systems. This is particularly important in the context of the National Park and the major role of the chalk aquifer in public water supply and its support to river flows in the region.

Figure 5.10 shows the extent of Groundwater Source Protection Zones (GSPZs). These will need to be considered with reference to the potential development areas to ensure that appropriate surface water management options can be identified that ensure runoff from the developed sites is not increased, but protect the quality of the groundwater resource. It is recommended that a series of policies are developed with regards to choice of SuDS type, in discussion with the Environment Agency and water companies, for locations overlying these zones.

The Outline Assessment considers the implications of local geology and the feasibility of different types of sustainable drainage (SuDs) to manage runoff.



Key:

- SDNPA boundary
- Local Authority boundary

Major Developments within 2km

- 100 - 500
- 500 - 1000
- 1000 - 3000
- 3000+

South Downs Source Protection Zones

- 3
- 1
- 2
- 4

0 20,000 Metres

Scale: 1:400,000 @ A3

H:\Projects\35227 South Downs Water Cycle Study\Drawings

South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.10
Groundwater Source Protection Zones (GSPZs)

December 2014
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5.1.6 Sewer Flooding

There are a number of records of sewer flooding across the study area. These are summarised in Appendix C (Tables C.5 and C.8). In particular Lewes and Petersfield have been affected alongside smaller settlements such as East Meon, Liss, and Twyford. Southern Water maintains a database of properties and locations affected by external or internal flooding due to hydraulic overload, usually caused by storm events where surface water drains into a combined sewerage system. The database (termed the DG5 database) provides records of sewer flood events that have historically occurred, but no mitigation scheme has been implemented. Where a scheme has been implemented to manage the risk, the record is removed from the database. Information from this has not been made available to this study, as releasing the sensitive information could impact property owners. In the context of new development, Southern Water considers that development could take place in areas that have experienced flooding provided the existing risk of flooding is not exacerbated. The company states that *"this position of no exacerbation is the minimum requirement. We would look for opportunities to reduce the risk of flooding if new development comes forward in those locations, subject to funding through the price review process. From a town and country planning perspective, Southern Water could not prevent connections to the sewerage system even if there is a risk of flooding, due to our statutory obligations. We would, however, as explained, seek to ensure that as a minimum the existing risk is not made worse. We look to the planning authority to support this approach."*

5.1.7 Artificial Sources

A range of reservoirs (termed 'large raised reservoirs' with a capacity above 25,000m^3)[29] are present within or upstream of the study area, from which there is a residual risk of flooding in the extreme case that the impounding structures fail. Whilst very unlikely, the consequences could be severe. Areas at risk are shown on the Environment Agency's reservoir flood maps[30]. It should be noted that a large proportion of these are not associated with water company supplies, but are features such as old mill ponds and lakes in landscaped gardens. Areas of risk are shown along the upper River Itchen, the Wallington River, sections of the River Arun, the River Lud//lower River Rother, the upper River Rother, River Ouse and the Cuckmere River.

5.1.8 Climate Change

Climate change is frequently cited as being one of the most significant threats to the long term sustainability of the environment. It is essential that the likely impact of climate change on the extent of the future Flood Zones is considered if development is to be sustainable over the long term.

NPPF and Defra Guidance

The 2006 Flood and Coastal Defence Appraisal Guidance (FCDPAG3) climate change guidance note "*Supplementary Note to Operating Authorities – Climate Change Impacts*"[31] recognises that climate change impacts on flooding are a challenge to Local Authorities. Impacts include sea level rise and a potential increase in the intensity

[29] https://www.gov.uk/reservoirs-a-guide-for-owners-and-operators
[30] http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?lang=_e&topic=reservoir
[31] http://archive.defra.gov.uk/environment/flooding/documents/policy/guidance/fcdpag/fcd3climate.pdf

and frequency of coastal storms. It is also predicted that rainfall events affecting flooding in fluvial catchments and urban surface water systems will increase in regularity and intensity. This guidance has been carried forward into the new NPPF guidance on climate change and flood risk, and remains in place for the Town and Country Planning system. In the future, the results of the UK Climate Impacts Program (UKCP09) may be used to provide updated guidance to replace this methodology.

Assessment of Climate Change Impacts

Managing climate change and the associated heightened flood risks are key components of NPPF. This SFRA assesses climate change at the strategic scale by considering its impacts resulting in increased flood extents. All Flood Risk Assessments to be undertaken within the SDNP should take into account climate change, for at least the next 100 years, unless it can be demonstrated that the development will have lifespan of less than 100 years in which case a shorter horizon would be considered acceptable, upon agreement with the Environment Agency. More information on how climate change may affect the extent of the Flood Zones in the study area and recommended Local Authority responses is provided in the Outline Assessment.

Table 5.1 Potential development areas and flood risk

ID	Development units	Local authority	Locality	Coastal flood risk	Coastal - justification	Fluvial flood risk	Fluvial - justification	Groundwater flood risk	GW - justification	Surface water flood risk	Surface water - justification
A01	100 - 500	Arun	Angmering	No	App. 2km from coast	No	App. 400 m from nearest river, Black Ditch, Lower Arun	Possible	Chalk	Possible	No other information
A02	100 - 500	Adur	Shorehampton Airport	Yes	Tidal River Adur FZ 3	Yes	River Adur FZ 3	Possible	Chalk	Possible	No other information
A03	100 - 500	Adur	Sompting	Yes	Adjacent to FZ3/FZ2 of Telville Stream, assumed tidal	Yes	Adjacent to FZ3/FZ2 of Telville Stream, assumed tidal	Possible	Chalk	Possible	No other information
A04	100 - 500	Adur	Sompting	No	App. 2km from coast	No	App. 900m from closest river, Telville Stream	Possible	Chalk	Possible	No other information
A05	100 - 500	Lewes	Peacehaven	No	App. 600m from the coast	No	App. 2800m from closest river, River Ouse tidal	Unknown	Lambeth Group	Possible	No other information
A06	100 - 500	Lewes	Lewes	Yes	In FZ2 of tidal River Ouse, at confluence of The Cockshut with the Ouse	Yes	In FZ2 of tidal River Ouse, at confluence of The Cockshut with the Ouse	Likely	Chalk overlain with alluvium	Possible	No other information
A07	100 - 500	Lewes	Ringmer	No	App. 600m to closest river, Bulldog Sewer & Green Man Spur, not sure if tidal	No	App. 600m to closest river, Bulldog Sewer & Green Man Spur	Unknown	Greensand	Possible	No other information
A08	100 - 500	Horsham	Pulborough / Codmore Hill	No	Inland location	No	App. 800m to closest river, Arun	Unknown	Greensand	Possible	No other information
A09	100 - 500	Winchester	Bishop's Waltham	No	Inland location with sufficient distance from river	No	App. 400m from closest river, River Hamble	Unknown	Lambeth Group	Possible	No other information
A10	100 - 500	Winchester	New Alresford	No	Inland location with sufficient distance from river	No	App. 500m from closest river, River Alre	Possible	Chalk	Possible	No other information
A11	100 - 500	Winchester	Otterborne/Twyford/Colden Common	No	Inland location with sufficient distance from river	No	App. 900m from closest river, Lower Itchen	Unknown	Lambeth Group	Possible	No other information
A12	100 - 500	Winchester	Denmead	No	Inland location with sufficient distance from river	No	App. 700m from closest river, Hambledon Stream	Unknown	Lambeth Group	Possible	No other information
A13	100 - 500	Winchester	Kings Worthy	No	Inland location with sufficient distance from river	No	App. 600m to closest rivers, Itchen and tributary	Possible	Chalk	Possible	No other information
A14	100 - 500	Winchester	Bishop's Waltham / Swanmore	No	Inland location with sufficient distance from river	No	App. 1000m to closest river, The Lakes	Possible	Chalk	Possible	No other information
A15	100 - 500	Winchester	Wickham	No	Inland location with sufficient distance from river	No	App. 500m from closest river, River Meon	Unknown	Bracklesham and Barton Groups	Possible	No other information
A16	100 - 500	Chichester	Westhampnett	No	Inland location with sufficient distance from river	No	App. 500m from closest river, River Lavant	Unknown	Lambeth Group	Possible	No other information
A17	100 - 500	East Hampshire	Liss	No	Inland location	Yes	In FZ2 of River Rother	Unknown	Greensand	Possible	No other information
A18	100 - 500	Worthing	Durrington	No	Inland location and closest river (200m) not tidal	No	App. 200m from closest river, Ferring Rife	Possible	Chalk	Possible	Urban, No other information
A19	100 - 500	Worthing	Durrington	No	App. 1000m from coastal flood zone	No	App. 1300m from closest river, Ferring Rife	Possible	Chalk	Possible	Urban, No other information
B01	500 - 1000	Adur	Lancing	Yes	Tidal River Adur FZ 3 and on coast	Yes	River Adur FZ 3	Possible	Chalk	Possible	No other information

ID	Development units	Local authority	Locality	Coastal flood risk	Coastal - justification	Fluvial flood risk	Fluvial - justification	Groundwater flood risk	GW - justification	Surface water flood risk	Surface water - justification
B02	500 - 1000	Brighton and Hove	Brighton, between London Road station and main station	No	App. 2300m from the coast	No	Not near any rivers	Possible	Chalk	Possible	Urban, No other information
B03	500 - 1000	Bighton and Hove	Red Hill	No	App. 3500m from the coast	No	Not near any rivers	Possible	Chalk	Possible	Urban, No other information
B04	500 - 1000	Lewes	Newhaven	Yes	In FZ2 of tidal River Ouse	Yes	In FZ2 of tidal River Ouse	Unknown		Possible	Urban, No other information
B05	500 - 1000	Wealden	Polegate	Possible	App. 200m from tidal/fluvial FZ2 and 3 on Wannock Mill Stream & Ditch	Possible	App. 200m from tidal/fluvial FZ2 and 3 on Wannock Mill Stream & Ditch	Unknown	Greensand	Possible	No other information
B06	500 - 1000	Chichester	Boxgrove	No	Inland location	No	App. 600m from River Lavant FAS	Unknown	Lambeth Group	Possible	No other information
B07	500 - 1000	Chichester	Chichester	No	Inland location	No	App. 1000m to closest river, River Lavant	Unknown	Lambeth Group	Possible	No other information
B08	500 - 1000	East Hampshire	Liphook	No	Inland location	Yes	In FZ2 of River Wey	Unknown	Greensand	Possible	No other information
B09	500 - 1000	East Hampshire	Horndean	No	Inland location	No	App. 800m to closest river, Lavant Stream	Possible	Chalk	Possible	No other information
B10	500 - 1000	Worthing	Durrington	Possible	App. 900m to coastal flood zone, Ferring Rife could become tide locked	Possible	Adjacent (opposite side of A2032) of the Ferring Rife	Unknown	Lambeth Group	Possible	No other information
C01	1000 - 3000	Brighton and Hove	Kingston by Sea	Yes	adjacent/in FZ 3 of tidal River Adur	Yes	Adjacent/in FZ 3 of tidal River Adur	Possible	Chalk	Possible	Urban, No other information
C02	1000 - 3000	Brighton and Hove	Ovingdean Marina	Yes	In FZ3	No	No river nearby	Unknown		Possible	Urban, No other information
C03	1000 - 3000	Winchester	Winchester	No	Inland location	No	App. 400m from closest river, Upper Itchen tributary, and on substantially higher ground than river	Possible	Chalk	Possible	No other information
C04	1000 - 3000	Winchester	Winchester	No	Inland location	Possible	App. 400m from FZ2 and 3 of Lower Itchen	Possible	Chalk	Possible	No other information
C05	1000 - 3000	East Hampshire	Petersfield	No	Inland location	Possible	App. 300m from Petersfield Stream, a tributary to the Western Rother, close to the Tilmore Brook	Unknown	Greensand	Possible	Urban, No other information
C06	1000 - 3000	East Hampshire	Alton	No	Inland location	Yes	Adjacent to FZ3/FZ2 of the River Wye	Possible	Chalk	Possible	Urban, No other information
D01	>3000	Mid Sussex	Burgess Hill	No	Inland location	Possible	App. 500m from River Adur	Unknown	Wealdon Group	Possible	Urban, No other information
D02	>3000	Eastbourne	Eastbourne	Possible	App. 100m from FZ2/FZ3	Possible	App. 100m from FZ2/FZ3	Possible	Chalk	Possible	Urban, No other information
D03	>3000	East Hampshire	Bordon	No	Inland location	No	App.1000m from FZ2/FZ3 of the river Deadwater	Unknown	Greensand	Possible	Urban, No other information

5.1.9 Scoping assessment overview of baseline flood risks

The Scoping Assessment reviews the range of flood risks across the study area. Whilst fluvial and tidal flood risk affect many areas, in particular Lewes, more notable risks are generally associated with surface water runoff and/or groundwater emergence. This is the case for the major developments situated in the SDNP study area, whether within or adjacent to the periphery of the park boundary.

Only three of the potential large-scale strategic development sites are located within the National Park itself, four locations are situated on watercourses upstream of the SDNP, and the remaining 31 sites are located downstream of the National Park. The Outline Assessment examines the risks to specific downstream sites (as per the SHLAA) from surface water runoff generated within the National Park. The level of all types of flood risk for each of the proposed large-scale development sites in the study is listed in Table 3.7.

Overview of flood risks within the study area:

- Liss: flood risk from the upper River Rother and tributaries, surface water flow paths and urban drainage. An incident of historic sewer flooding;
- Petersfield (upper River Rother): flood risk from the upper River Rother and tributaries, surface water flow paths and urban drainage. An incidence of groundwater flooding from chalk at Petersfield is mentioned (SFRA review); although geological mapping indicates Petersfield overlies greensand/clay deposits. Multiple incidents of past sewer flooding; and
- Lewes (River Ouse): River Ouse combined tidal/fluvial flood risk, groundwater emergence in various areas, particularly along the Winterbourne. Surface water flooding, associated with dry valleys and where various raised embankments crossing flow paths. Exceedance of the piped drainage systems (multiple past sewer flooding incidents). Tidelocking and backing up of piped drainage systems/tributary watercourses due to high water levels in the River Ouse.

Developments in these locations will need to demonstrate that flood risk (at the developments themselves, and with regards to people and property downstream) is managed appropriately. They will also need to include appropriate arrangements for the management of runoff from the developments (SuDS). This is a requirement of the NPPF. For developments within low-lying areas of Lewes the implications of tidelocking on SuDS discharge will need to be considered to ensure new developments have appropriate drainage systems. High groundwater levels may also pose a constraint on the choice of SuDS.

Upstream of the SDNP, major developments are proposed at: New Alresford, Kings Worthy (both adjacent to the River Itchen), Pulborough (River Arun), and Burgess Hill (River Adur). Under the NPPF, as for all locations, developments will need to demonstrate that flood risk (at the developments, and with regards to people and property downstream) is managed appropriately. They will also need to include appropriate arrangements for the management of runoff from the developments.

Areas to be considered in the SFRA Level 1

The Outline Assessment considers the risks and recommendations more precisely in relation to the more detailed development plan data in the Strategic Housing and Land Availability Assessment (SHLAA) produced by the SDNPA in June 2014. Based on the review of available flood risk information against the proposed major developments the following recommendations are made:

- The main focus of the SFRA Level 1 is Liss, Petersfield, and Lewes due to the level of flood risk and proposed development at these locations within the SDNP. These areas are assessed in further detail given the flood risk and development pressures;
- For the four locations identified upstream of the SDNP– Table 5.1 is developedwith further detail using information from the SHLAA. A check list of flood risk issues in these areas is presented for use by SDNP when consulted on major development applications in these areas. This reiterates the requirements of NPPF, particularly with reference to preventing an increase in downstream flood risk and runoff management (SuDS); and
- For the 31 locations downstream of the SDNP: Table 5.1 is developed with further detail using information from the SHLAA. A check list of flood risk issues in these areas is presented for use by SDNP when consulted on major development applications in these areas. A further appraisal of the potential for land and development within the SDNP to affect these locations is undertaken, particularly with reference to surface water flood risk.

The risk assessment summarised in Table 5.1 identifies the following data gaps:

- Lack of SWMPs for Petersfield and Liss;
- Lack of potential development area polygons – flood risk in areas such as Lewes is complicated and from multiple sources/via multiple pathways. Further location focus is required to provide specific recommendations; and
- Awaiting additional flood risk data (surface water, groundwater, DG5 ‘sewer flooding’ records).

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- The main focus of the SFRA Level 1 is Liss, Petersfield, and Lewes due to the level of flood risk and proposed development at these locations within the SDNP. These areas are assessed in further detail given the flood risk and development pressures;
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- For the 31 locations downstream of the SDNP: Table 5.1 is developed with further detail using information from the SHLAA. A check list of flood risk issues in these areas is presented for use by SDNP when consulted on major development applications in these areas. A further appraisal of the potential for land and development within the SDNP to affect these locations is undertaken, particularly with reference to surface water flood risk.

5.2 Level 1 SFRA

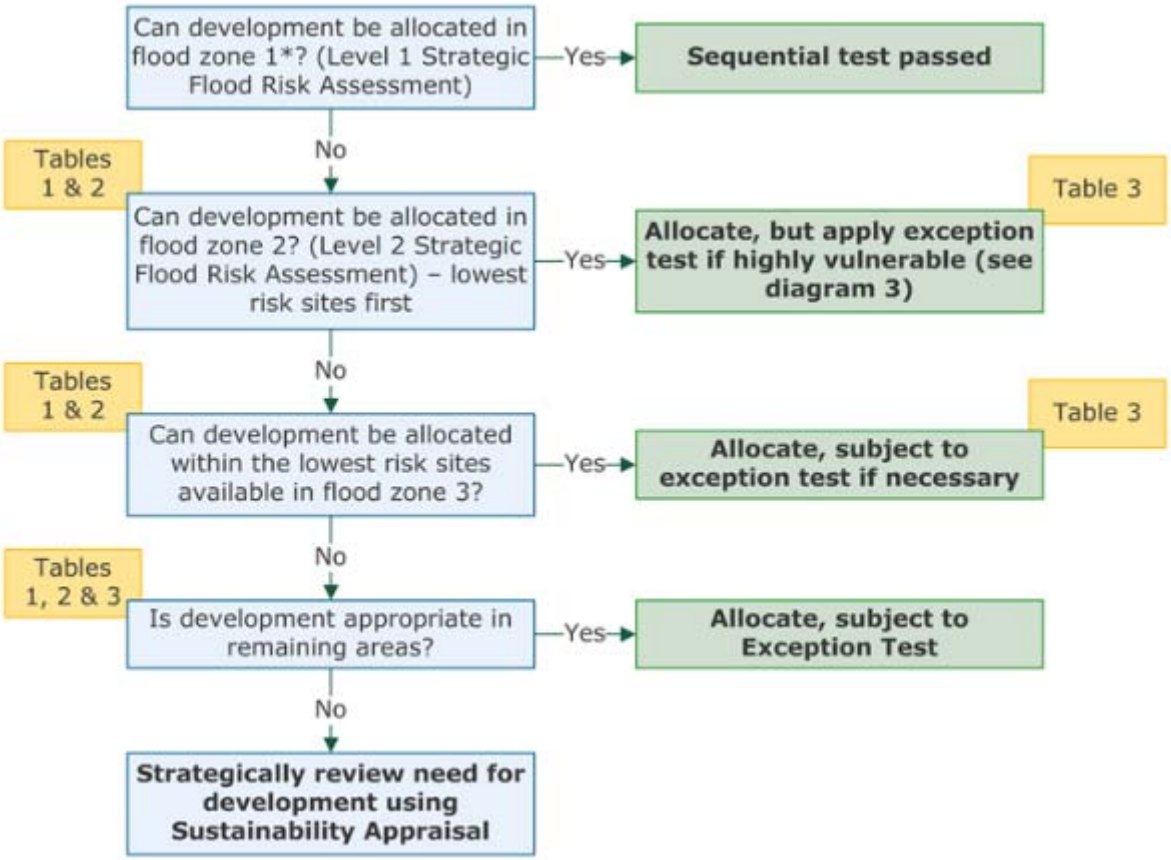
5.2.1 Overview

This Level 1 SFRA has been prepared for the South Downs National Park Authority (SDNPA). The document serves as one component of the statutory evidence base underpinning the Local Plan. Within this report, the SFRA is split over two sections: baseline flood risk data collected at the study scoping stage (see section 3.6); and the main Level 1 SFRA (this section). The SFRA is designed to support spatial planning decisions at the National Park scale. This includes the delineation of NPPF flood risk zones, an assessment of the implications of climate change, and a review of flood risks from all key sources. The detail of the assessments has been determined by the availability of information and data.

The National Planning Policy Framework (NPPF, March 2012) sets out government's national policy on development and flood risk on different aspects of land use planning in England. It is supported by the Planning Practice Guidance (PPG, March 2014) which promotes two levels of SFRA. A Level 1 SFRA is defined in the PPG as a study collating existing information to allow the application of the Sequential Test, a test that seeks to direct development to potential development areas with a low risk of flooding. The Sequential Test in turn identifies whether there is a requirement for the Exception Test to be applied. The Exception Test will need to be applied if SDNPA identify a need to allocate development sites for land use types which are not compatible with the flood risk designations (as per Table 1 and 2 in NPPF). There are a number of reasons why SDNPA may allocate sites in this way; if this is the case then site specific FRAs will be required. Alternatively for strategic development areas SDNPA may wish to consider a Level 2 SFRA.

The SDNP Level 1 SFRA has been prepared to enable the application of the flood risk management hierarchy advocated by NPPF. Figure 5.11 details this approach.

Figure 5.11 Flood risk management hierarchy



Source: NPPF Flood Planning Practice Guidance (2014). NPPF Tables 1, 2 and 3 can be found in Appendix C (as Tables C.9, C.10 and C.11).

5.2.1.1 Relevant Legislation

National Planning Policy Framework NPPF

NPPF specifies that Local Planning Authorities (LPAs) such as the SDNPA should adopt a risk-based approach to planned development through the application of a Sequential Test, which seeks to steer new development towards areas of lowest flood risk. NPPF also sets out the need to treat other sources of flood risk (such as groundwater and surface water) consistently with river flooding. The extent of areas affected by these sources of flooding should be mapped to flag the need to identify the hazard posed to development from these sources of flooding. Then with an understanding of development vulnerability, risks can be proactively managed by the spatial planning process, and, if necessary development design to minimise the consequences. This process should include an assessment of the implications of climate change on flood risk.

NPPF includes the Exception Test which, if justified, allows some scope for departures from the sequential approach. This is for circumstances where it can be: "*demonstrated that the development provides wider sustainability benefits*

to the community" (NPPF paragraph 102). However, providing the evidence to justify a departure from the sequential approach on this basis is only one part of the Exception Test. To be permitted, proposed developments will need to demonstrate that flood risks are appropriately managed, the development is safe and flood risk elsewhere is not increased. NPPF directs planning authorities to take opportunities to reduce flood risk through development. The SDNPA will seek to work with developers to encourage developments that contribute to an overall reduction in flood risk.

Town and Country Planning Guidance

The Town and Country Planning (Flooding) (England) Direction 2006 has made the Environment Agency (EA) a statutory consultee on all applications for development in flood risk areas, including areas with critical drainage problems and for developments exceeding 1 hectare outside flood risk areas. After discussion with the EA, LPAs are required to notify the Secretary of State if they remain minded to approve a planning application contrary to a sustained objection from the EA.

Local Development Plan and Local Development Framework

As a relatively new (2011) National Park, the SDNP does not yet have its own Local Plan (a plan is in preparation). Planning Policy is instead currently guided by saved Local Plan Policies and adopted Core Strategies prepared by the Local Authorities [32]. The current coalition Government has signalled a continued commitment to local plan-making and decision making based on the local development plan and strengthening local community planning powers. In producing its Local Plan, the SDNPA should seek to enable future development that is at the lowest possible risk of flooding and contributes to reducing the existing level of flood risk over the wider SDNP area. This SFRA forms part of the evidence base required to do so.

Table 5.2 of this SFRA details the land uses that the NPPF considers appropriate for each of the national flood risk zones. The SDNP's Strategic Housing Land Availability Assessment (SHLAA) details potential residential developments, which under Table 2 of the NPPF Practice Guidance (see Appendix C, Tables C.9 to C.11) are classified as 'More Vulnerable' and the level of flood risk posed to each site. Table 5.1 and 5.3 detail the level of flood risk to potential development areas, and SHLAA sites respectively, so as to provide a means of ranking them, and where possible directing development to those at the lowest risk of flooding. The SDNPA should use this table to apply the Sequential Test as part of the spatial planning process undertaken to best locate future development. Figures 5.12 to 5.17 highlight the relationship between fluvial/tidal and surface water flooding to the SHLAA sites in Lewes, Liss, and Petersfield.

Areas where flooding issues have been identified will require detailed policies and/or constraints in the Local Plan. This SFRA forms part of the statutory evidence base to support the spatial planning process.

Flood and Water Management Act 2010

The Flood and Water Management Act (2010) responds to recent pressure to introduce legislation to address the threat of flooding and water scarcity, both of which are predicted to increase with climate change.

[32] http://www.southdowns.gov.uk/planning/planning-policy/current-policy

In terms of the SFRA, the key parts of the Act are:

- Requires the EA to create a National Flood and Coastal Erosion Risk Management Strategy, which a number of organisations will have to follow;
- Lead Local Flood Authorities (LLFAs) which, in this case the Hampshire, West Sussex, and East Sussex County Councils, and Brighton & Hove City Council, are now responsible for the preparation of the Counties' Preliminary Flood Risk Assessments (PFRA);
- Requires leading LLFAs to create Local Flood Risk Management Strategies (LFRMS);
- LLFAs are responsible for consenting works within 8m of bank top of Ordinary Watercourses[33];
- Enables the EA and local authorities more easily to carry out flood risk management works;
- Introduces a more risk-based approach to reservoir management; and
- Requires the use of sustainable drainage systems in certain new developments.

5.2.1.2 The purpose of the South Downs National Park Level 1 SFRA

The Level 1 SFRA is intended to:

- Identify Main Rivers[34], Ordinary Watercourses and flood zones within the SDNP;
- Assess the potential impact of climate change on flood risk;
- Identify areas at risk from other sources of flooding such as surface and ground water;
- Identify flood risk management measures including their location and standard;
- Consider the potential for new development to increase flood risk elsewhere through increased runoff;
- Provide guidance on the application of the Sequential Test; and
- Provide guidance on flood risk management through the design process.

The SDNP has an area of 1,627km^2. The park is elongate, extending 115km west-east following the chalk ridge from the outskirts of Winchester to the outskirts of Eastbourne. As the National Park area is defined by the chalk downland

[33] An ordinary watercourse is any watercourse (river, stream, ditch, cut, sluice, dyke or non-public sewer) that is not identified as a Main River on maps held by the EA.
[34] The currently designated Main Rivers in England are shown on the EA's Flood Maps. These rivers provide a key role in terms of draining significant areas of land, and often also have significant areas of adjacent development potentially at risk of flooding. The EA is the statutory body responsible for Main Rivers.

and areas of the Weald, in a north-south direction the SDNP extends for as little as 5km in the east and up to 30km in the centre. The National Park therefore straddles multiple catchments, local authorities, existing patterns of settlement and economic areas. The National Park encompasses both areas of known flood risk and areas where flood risk is not perceived to be a restriction to planning. Development pressures in the National Park are low outside of the key towns owing to the great weight given to conserving landscape and scenic beauty in the National Park and Areas of Outstanding Natural Beauty that preceded it. Current development and planned future development within the NP are concentrated in the key settlements within the park, namely Lewes, Liss, Midhurst and Petersfield. Development pressures are concentrated in adjacent areas (i.e. Brighton and Hove, Worthing and Winchester) around the edge of the park. This SFRA has been prepared to provide guidance to inform the application of the Sequential Test for sites identified by the SDNPA, and to allow the SDNPA to make informed decisions when processing windfall site applications.

Using the Level 1 SFRA

The SFRA is a tool to assist the SDNPA in the spatial planning process to ensure flood risk is fully taken account of in the planning of future development. The information has been presented in such a way to facilitate this objective.

For the purposes of informing the Sequential Test the key parts of the SFRA are:

- Figures 5.2 and 5.12 to 5.17 in conjunction with Table 5.3;
- Section 5.2.2 – Information to support the Sequential Test; and
- Section 5.2.3 and 5.2.4 – Guidance on appropriate flood risk management.

Structure of the Level 1 SFRA

The structure of this Level 1 SFRA is aligned with delivering the key aim of providing information for the SDNPA to perform the Sequential Test. The SFRA is embedded in the SDNP Water Cycle Study and makes use of information gathered at the SFRA scoping stage. The SFRA comprises the following sections:

- Section 5.1: provides the baseline flood characterisation as part of the Scoping Assessment. Available information on flood risk from different sources has been compiled from other documents and is presented along with mapping;
- Section 5.2: provides the Level 1 SFRA as part of the Outline Assessment:
  - Section 5.2.1: provides an overview of the SFRA and sets it within national planning policy. The introduction is also designed to provide guidance on how to use the SFRA as a planning tool;
  - Section 5.2.2.2: describes potential flood risk management approaches in SDNP, through the planning process, including the sequential test, and guidance on processing windfall site applications;

- Section 5.2.3: details how flood risk can be managed through the site design process;
- Section 5.2.4: outlines the principles of sustainable surface water management in SDNP;
- Section 5.2.5: describes the need for Flood Risk Assessments (FRAs); and
- Section 5.2.6: summarises the key findings and implications of the SFRA and makes recommendations.

5.2.2 Flood Risk Management through Planning

Sections 5.2.2.2 and 5.2.3 discuss how flood risk can be managed. The approach outlined in this SFRA follows the sequential risk based approach required by the NPPF. The SFRA process is designed to allow the SDNPA to use avoidance of flood risk as the principal method of managing flood risk through the spatial planning process. If, in exceptional circumstances, following application of the Sequential Test development is proposed in areas of flood risk, the SFRA provides guidance on managing the risk through site layout and building design. In these circumstances the SDNPA will need to carry out the Exception Test, based on information supplied by in the FRA by the developer, to confirm that requirements of the test, and NPPF have been met.

5.2.2.1 Sequential Approach

Through the planning process, NPPF aims to reduce the flood risks faced by future developments, and advocates a risk avoidance approach to spatial planning. A sequential risk-based approach should be applied at all levels of the planning process, starting at the strategic scale. All strategic allocations should be directed to the lowest areas of flood risk, particularly in Petersfield and Liss where the proportion of land within Flood Zones 2 and 3 is relatively small. For vulnerable uses, key development locations with a low risk of flooding should be favoured over those at greater risk. The approach should though extend down to the site master-planning scale, for example placing the most vulnerable developments on the lower risk areas of a site, and setting aside high risk areas for water compatible uses. Whilst the sequential process prevents development being steered towards high-risk areas, it accommodates development in areas of risk if it can be shown that the development is not vulnerable to flooding.

In delivering the projected growth over the plan period, the SDNPA should seek to direct development vulnerable to flooding, such as housing, to sites which the Level 1 SFRA has identified as being in Flood Zone 1, before sites within Flood Zones 2 and 3. Sites within Flood Zones 2 and 3 should only be considered **only** if there are insufficient other sites, or because other sites located within flood risk areas need to be developed for wider sustainability reasons.

Sequential Test

The NPPF defines the Sequential Test as a process to steer new development to areas with the lowest probability of flooding. Sequential Test is a key component of the hierarchical approach to avoiding and managing flood risk. The SFRA has mapped the fluvial/tidal Flood Zones in the National Park as a whole (Figures 5.2) and for the three main settlements Lewes (Figure 5.12), Liss (Figures 5.14), and Petersfield (Figure 5.13). Table 5.2 presents details of land use types appropriate for each zone. Further guidance on the appropriateness of land use types for each zone is

available in Table 2 of th e PPG's Flood Zone and F lood Risk Tables, a copy of which is provided in A ppendix C (Tables C.9 to C.11). There are several key points that the SDNPA should consider when applying the Sequential Test, these are outlined below.

- Increasing the vulnerability of a site by proposing an alternative use of a higher vulnerabilit y (even if consistent with the risk) is consid ered an increase in flood risk and not in line with the principals of NPPF;
- The most vulnerable land uses should be allocated first, in areas of least risk; and
- Placing less vulnerable uses in low risk areas and thus reducing the amount of available space for more vulnerable uses in the lower risk zones is not appropriate. Such a situation can only be considered if it can be demonstrated that the onl y suitable site for the low vulnerability land use is in the area of low risk.

Table 5.2 Flood zone designations

EA Flood Zone Name (as per Figures 3.9)	Probability	SDNP SFRA Flood Zone Designation	NPPF Land Use Guidance
Flood Zone 3b*	Functional Flood Plain	Zone 3b	Only the water compatible uses and essential infrastructure listed in Table C.10 of Appendix C should be permitted in this zone. Development should be designed and constructed in such a way 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 Essential Infrastructure in this zone should pass the Exception Test.
Flood Zone 3a*	High	All undeveloped Flood Zone 3 to be treated as Zone 3b until shown otherwise	Only less vulnerable and water compatible uses listed in Table C.10 of Appendix C should be permitted in this zone. The exception test is required for more vulnerable uses and essential infrastructure. Essential infrastructure should be designed and constructed to remain operational and safe in times of flood.
Flood Zone 2	Medium	Zone 2	Water compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table C.10 of Appendix C are appropriate in this zone. Subject to the Sequential Test being applied, the highly vulnerable uses in Table C.10 of Appendix C are only appropriate in this zone if the Exception Test is passed. All development proposals in this zone should be accompanied by a FRA.
Flood Zone 1	Low	Zone 1	All uses of land are appropriate in this zone. Other sources of flooding should be reviewed. FRAs are required for sites over 1ha. It is recommended that Drainage Impact Assessments are made mandatory for sites over 0.25 ha (See section 5.2.3).

EA Flood Zone Name (as per Figures 3.9)	Probability	SDNP SFRA Flood Zone Designation	NPPF Land Use Guidance
Land within 50m of any watercourse (Main River/Ordinary Watercourse	Included so as to ensure the flood risk / Flood Zone in which the land lies is defined as part of a FRA. Once defined, the guidance for land in Flood Zones 1, 2, 3a and 3b above should be followed.		Modelled flood fluvial/tidal extents only cover the key watercourses/low-lying areas. Smaller watercourses may pose risks to adjacent land, but this may not have been modelled. These models also use coarser topographic data, and comparison of site specific topographic data with flood level/extent information may alter the Flood Zone classification of the site.

Guidance for zones 3b, 3a, 2 and 1 based on Table 3 of the PPG's Flood Zone and Flood Risk Tables (see Appendix C, Tables C.9 to C.11)

*The distinction between Flood Zone 3a and 3b has not been made. Therefore all undeveloped areas in Flood Zone 3 have assumed the definition of Functional Floodplain – see text for further details.

Data to Support Application of the Sequential Test

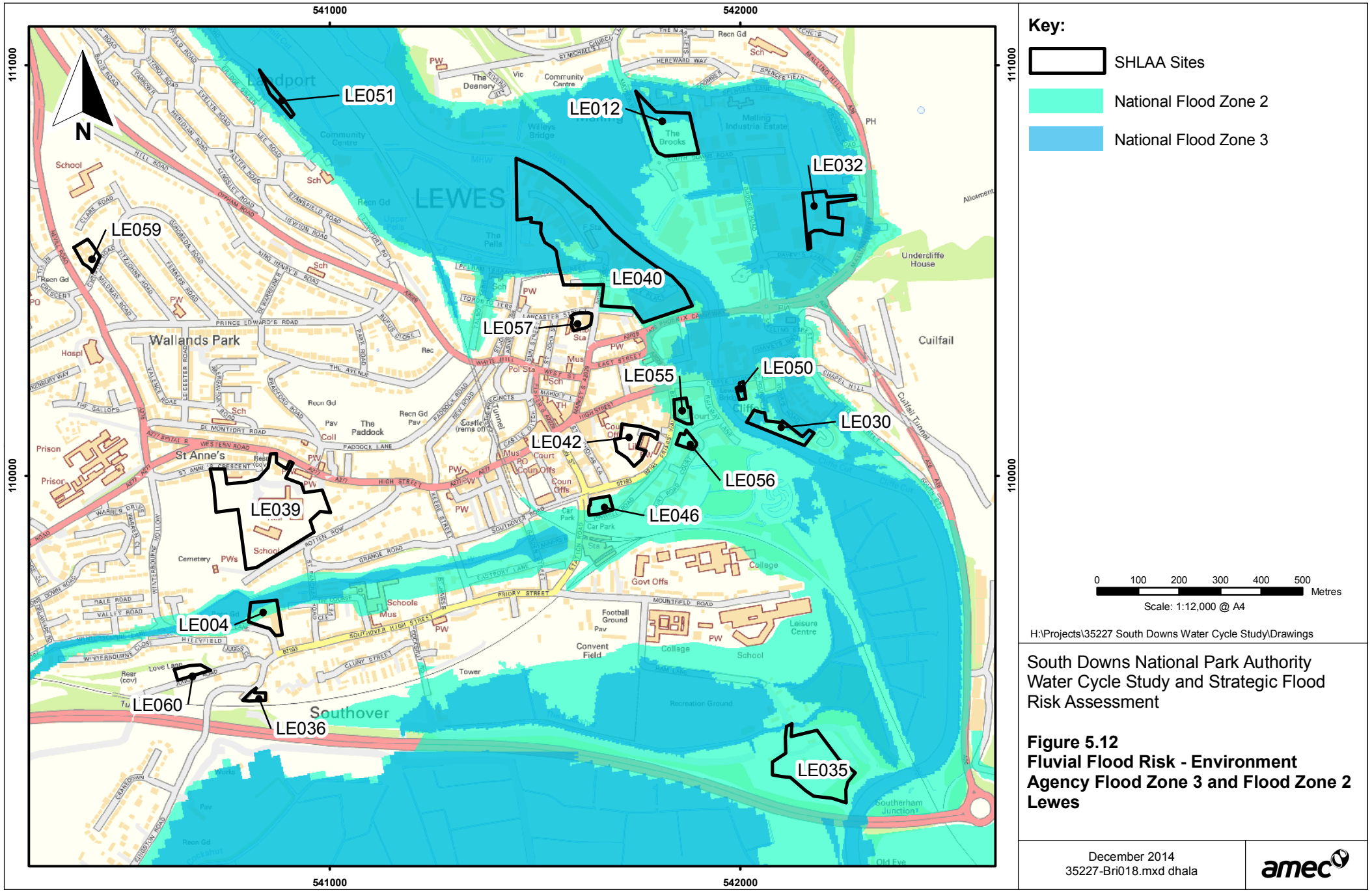
Fluvial and Tidal Flood Risk

The Flood Zones, supplied by the EA are presented in Figure 5.2 for the South Downs National Park as a whole and in Figures 5.12 to 5.14 for the settlements of Lewes, Liss, and Petersfield. Land in Flood Zone 3 is coloured dark blue (highest flood risk); Land in Flood Zone 2 is coloured light blue. Any land outside the blue areas is classed as being in to Flood Zone 1 (i.e. the zone of lowest fluvial/tidal flood risk). The EA's fluvial and tidal risk definitions for the Flood Zones are set out in section 5. 1.1 of this document. Whilst the Flood Zo ne mapping is sufficient to inform the SDNP's strategic spatial planning; for site specific applications, the developer will need to consult the EA to obtain the most up to date flood risk data for th e site. The EA provides a pre-application advice s ervice for developers, subject to payment of a fee [35].

NPPF distinguishes between Flood Zone 3a and 3b, with Flood Zone 3a being defined as 'High risk' and Flood Zone 3b defined as the Functional Floodplain (section 5.1.1). From a spatial planning and development control perspective, all currently undeveloped areas of Flood Zone 3 should have the more severe Flood Zone 3b planning restrictions applied, as per NPPF Tab le C.11 in Appendix C. In line with NPPF, this approach excludes all but essential infrastructure (pending application of the Exception Test) and w ater compatible uses from Flood Zone 3. This designation should remain in place until that time when it is proven otherwise through the use of detailed hydraulic models which adequately define the actual extent of the Functional Floodplain. The definition of Flood Zones 3a and 3b will be necessary if development is proposed within areas of Flood Zone 3. In m ost situations, a 1D-2D linked model will be the most appropriate modelling approach for this. As part of this modelling it is recommended that the model defines the flood depth, velocities and hazard rating associated with flood return periods up to and including the 1 in 100 year (plus climate change) event. This will enable a sequential approach to be applied to the spatial distribution of land uses within the floodplain.

Information on other sources of floodi ng can also be used in the application of the Sequential Test, if there are otherwise equally suitable sites available for allocation in Flood Zone 1.

[35] Further details can be found at: https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion



South Downs National Park Authority Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.12
Fluvial Flood Risk - Environment Agency Flood Zone 3 and Flood Zone 2 Lewes

December 2014
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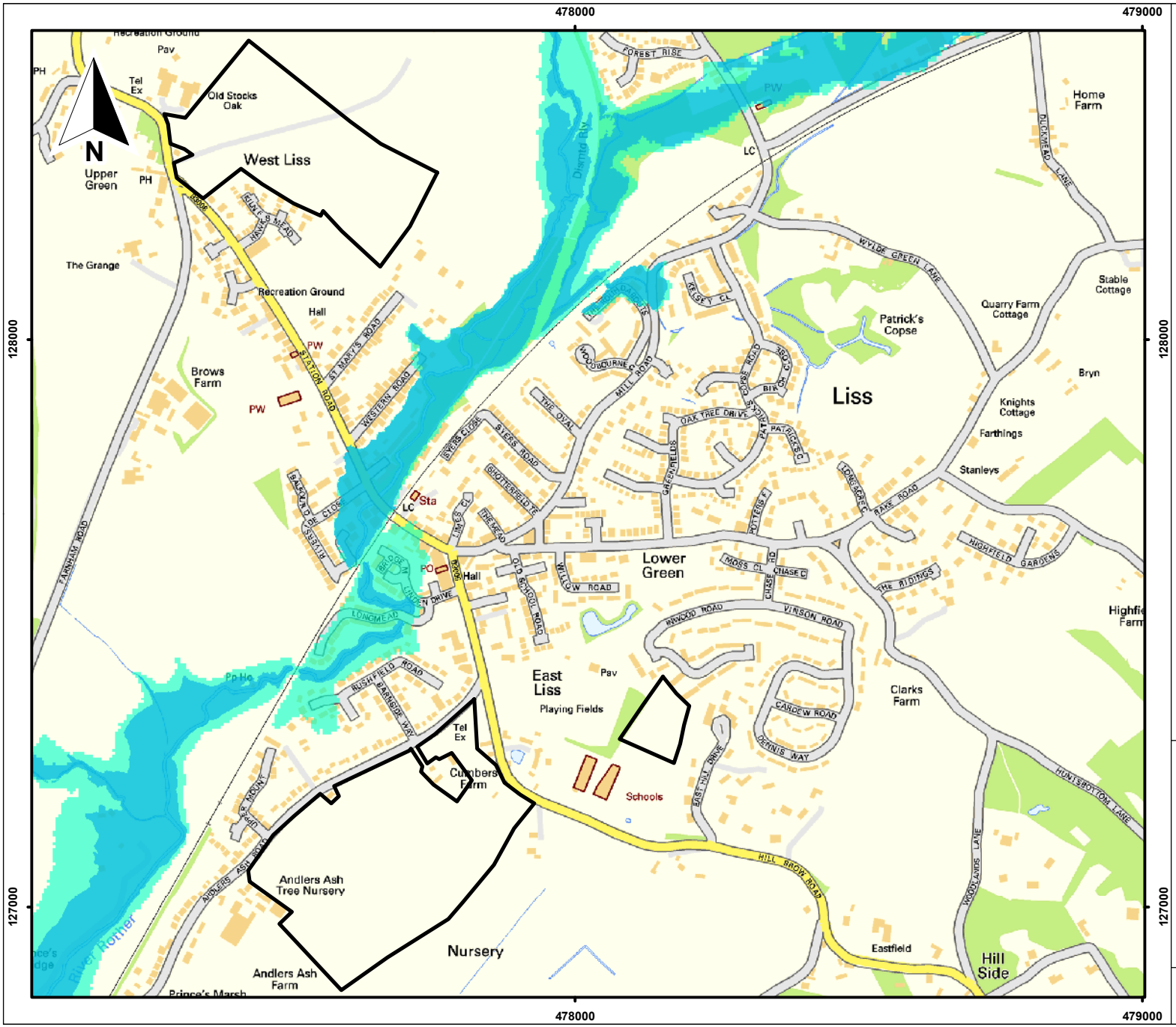
amec



South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.13
Fluvial Flood Risk - Environment Agency Flood Zone 3 and Flood Zone 2 Liss

December 2014
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amec

474000 475000 476000

125000 124000 123000 122000

Key:

- SHLAA Sites
- National Flood Zone 2
- National Flood Zone 3

EA051 EA070 EA108 EA116 EA064 EA078 EA175 EA050 EA055 EA005 EA112 EA062 EA054 EA074

0 500 Metres

Scale: 1:12,000 @ A3

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South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.14
Fluvial Flood Risk - Environment Agency Flood Zone 3 and Flood Zone2 Petersfield

December 2014
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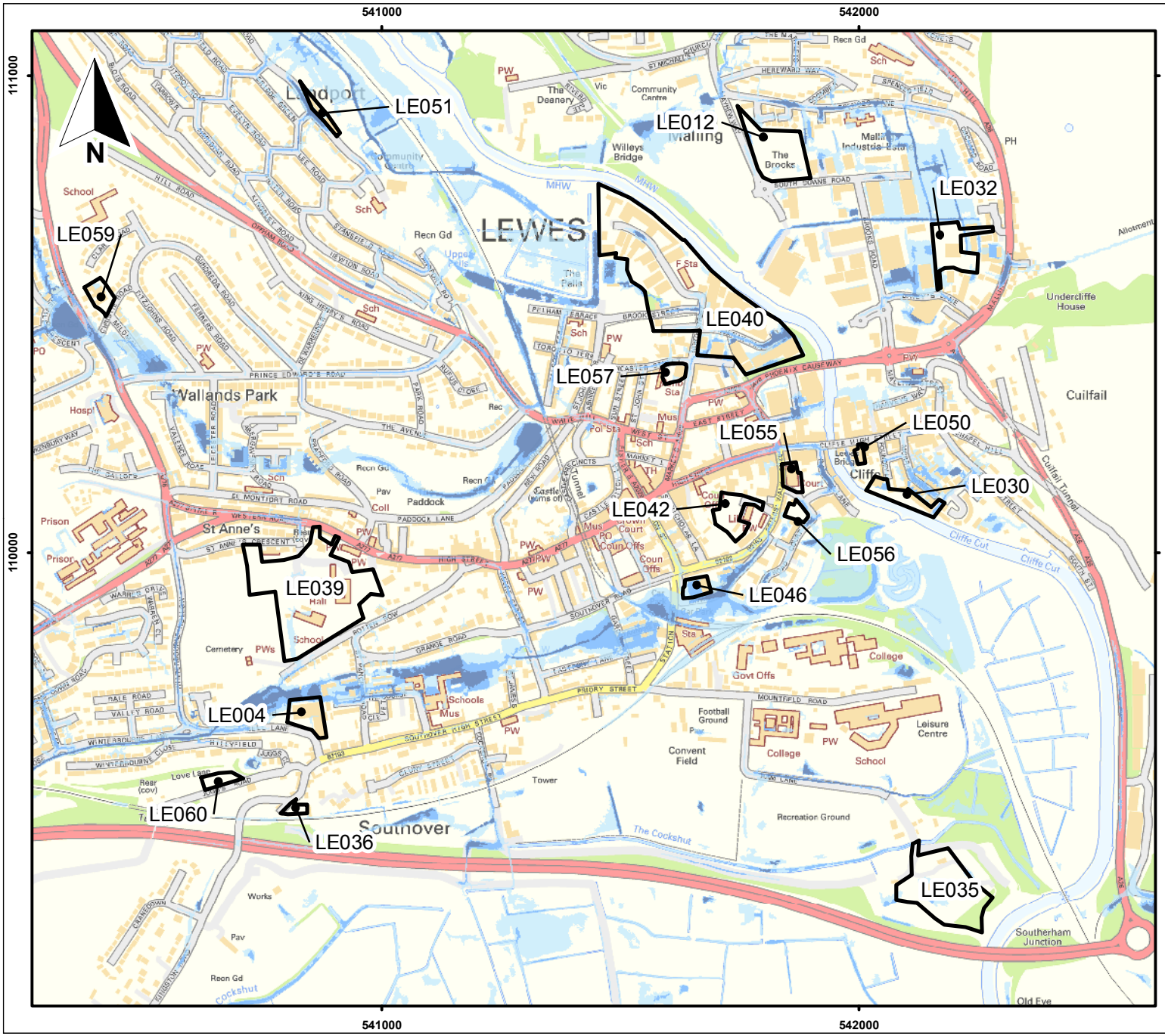
amec

Surface Water Flood Risk

The Flood Map for Surface Water (FMfSW) should be used to guide vulnerable development away from areas potentially at risk of surface water flooding. The FMfSW is shown in Figures 5.15 to 5.17 for the main settlements in the National Park. The mapping is also available within the EA section of the UK's "www.gov" website.

At the strategic scale the SDNPA should directing vulnerable development to areas of greenfield land where mapping shows that frequent surface water flood risk covers large proportions of the site. For larger sites that include amenity areas, areas of risk may be able to be set aside as green corridors and utilised as 'green infrastructure'. For brownfield sites, a more pragmatic approach is required. If there are equally suitable sites for development in Flood Zone 1, but some are identified as having a substantial risk of surface water flooding, it may initially appear preferable to allocate development to the lower risk sites first. However, opportunities may exist on strategic, higher-risk sites to provide strategic management of surface water flooding. By managing the risk of surface water flooding, this may both enable development, and reduce flood risk to existing development nearby. Equally, poor master-planning of sites will have consequences in increasing flood risk above the lower level of risk achievable with more careful planning. Compared to other types of flooding, with surface water, there is a larger scope for site design to manage and reduce the risk of flooding from this source.

Smaller higher risk sites may need to be considered together as part of a Surface Water Management Plan/Integrated Urban Drainage studies, where reducing surface water flood risk at the site is dependent on off-site measures. Where clusters of sites with a common flood risk blight are identified, the SDNPA should consider facilitating these strategic studies through partnership working. If a site is promoted by a developer for development before a strategic solution is identified, the development should, as a minimum incorporate measures so as not increase flood risk elsewhere, and include appropriate flood resilience measures to acceptably manage surface water flood risk.



Key:

SHLAA Sites

Risk of Flooding from Surface Water

- High
- Medium
- Low

0 100 200 300 400 500 Metres

Scale: 1:12,000 @ A4

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South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.15
Flood Risk from Surface Water
Lewes

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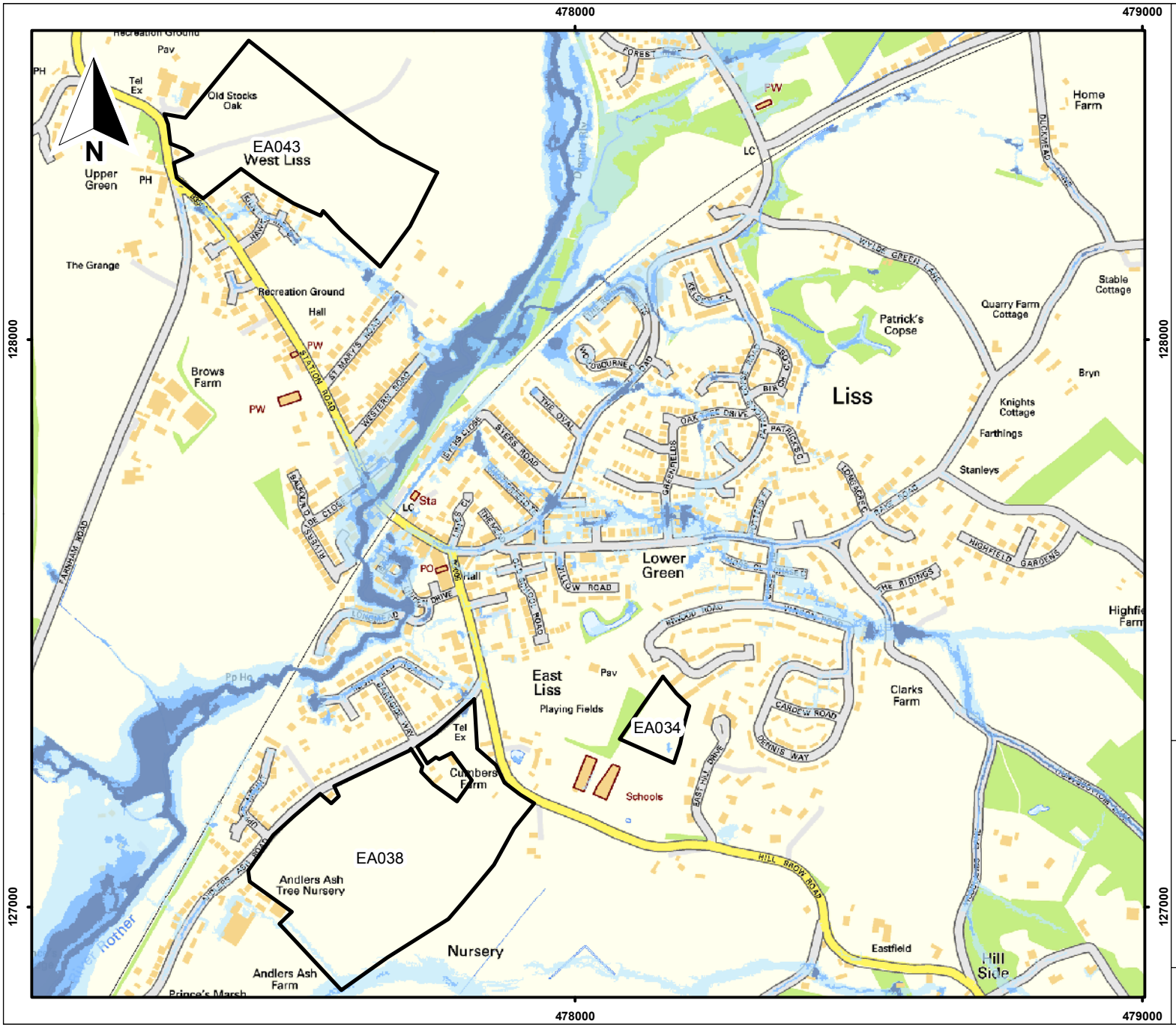

Key:

SHLAA Sites

Risk of Flooding from Surface Water

- High
- Medium
- Low

0 100 200 300 400 Metres

Scale: 1:10,000 @ A4

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South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.16
Flood Risk from Surface Water
Liss

December 2014
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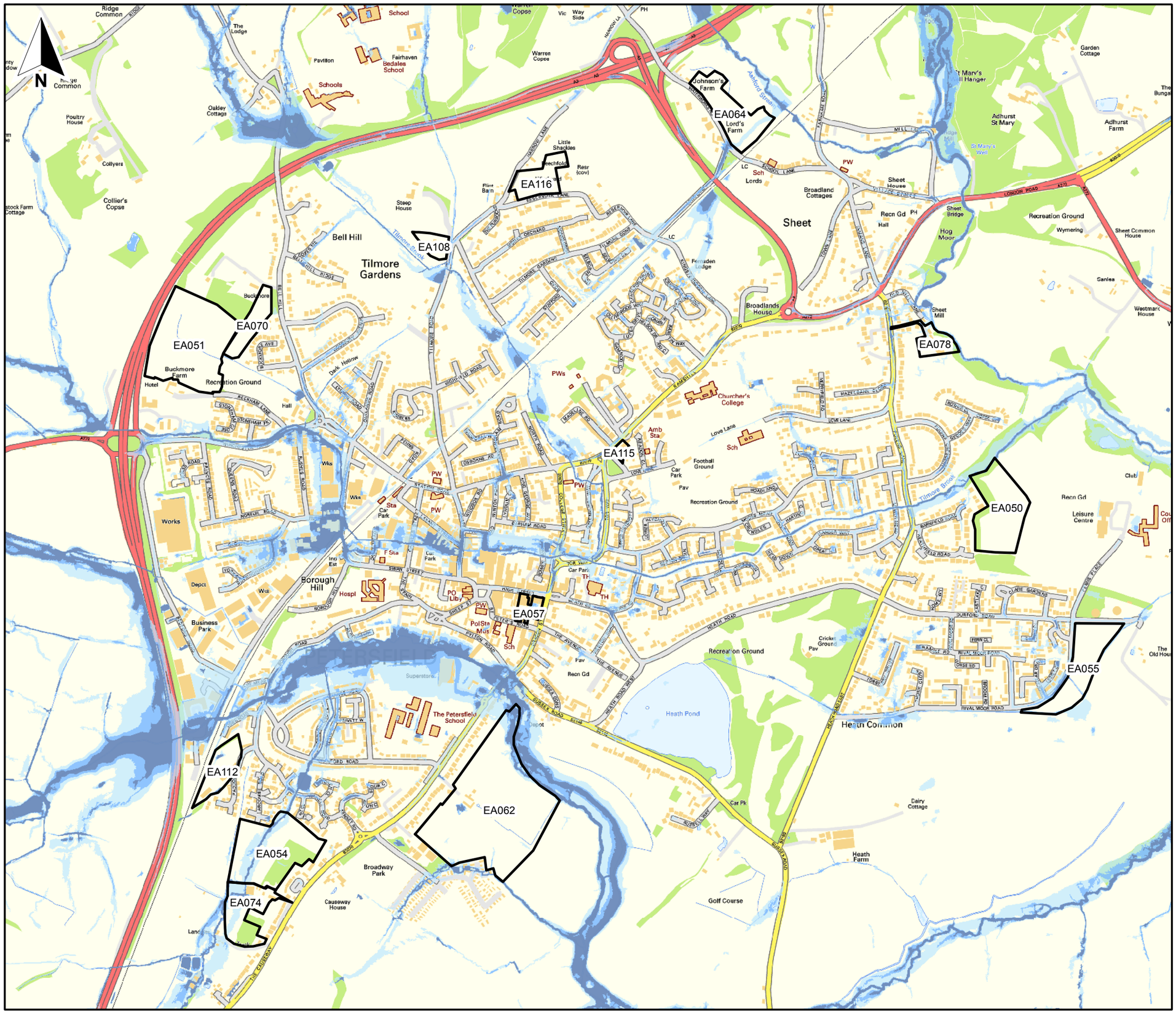

Key:

SHLAA Sites

Risk of Flooding from Surface Water

- High
- Medium
- Low

0 500 Metres

Scale: 1:10,000 @ A3

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South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.17
Flood Risk from Surface Water
Petersfield

December 2014
35227-Bri023.mxd dhala

amec

Groundwater Flood Risk

The risk of groundwater flooding should also be taken into account in the Sequential Test. Supporting geological information is presented in the Scoping Assessment, figures 5.6 to 5.10.

Unlike surface water flooding, groundwater flooding causes prolonged periods of flooding and mitigation options are more limited. Whilst storage may be a viable option for temporary urban drainage capacity exceedance (rain falling faster than the local drains can function), the volumes of water emerging during groundwater flooding limit the utility of this approach. Similarly, groundwater flooding may lead to developments being cut-off by flood water for periods of months, rather than the hours/days that are typical of surface water/fluvial flooding.

The groundwater risk map in the Scoping Assessment (Figure 5.10) provides details of the risk in terms of probability within 50m by 50m cells, but actual mapped extents are not available, being dependent on the specifics of the local topography and hydrogeology. Mapping of other sources of flood risk (tidal/fluvial/surface) can provide a basic guide in the sense that these highlight the lowest-lying areas, where groundwater might be most likely to emerge. Existing SFRAs and PFRAs provide some background information on historic groundwater flooding (although records are often limited to existing developed areas only), and OS mapping can be used to provide an indication of the locations of some springs (often noted as 'issues'). However, available data does not document every spring, depression, dry valley, or geological feature that governs the occurrence of groundwater flooding.

At the strategic scale the SDNPA should avoid allocating areas of greenfield land wholly within the 'high risk' category (greater than 75 percent) for vulnerable development. For brownfield sites, a more pragmatic approach is required to prevent urban blight. Whilst development should not be precluded, less-vulnerable uses should be considered in preference.

For specific sites available groundwater flood risk information will need to be assessed. This process may identify the need for more detailed studies to better define risk depending on the nature of the development proposals. Once there is confidence that the nature of the risk is understood, the sequential approach should be taken, on many sites it will be possible to set aside high-risk areas for low-vulnerability/water compatible uses, and locate more vulnerable development on areas at lower risk. Site-master-planning should avoid setting development in low-points, or blocking flow routes through a site. On some constrained sites, avoidance options may be limited and flood resilience measures (measures such as raised floor levels) should be considered.

Guidance on applying the Sequential Test

This section provides specific guidance for the SDNPA on applying the Sequential Test. Further guidance on the application of the Sequential Test is available on the UK government's website [36], which includes a link to specific Sequential Test guidance produced by the EA [37].

Strategic Sites

Table 5.1 details the strategic developments (100 to 3000 units) in the vicinity of the SDNP. The table indicates the relevant sources of flood risk in vicinity of these developments. The majority of these developments, whilst being located within the study area, are located within the 2km wide buffer zone around the edge of the SDNP, rather than being in the SDNP itself. Three strategic development locations are though inside the SDNP, these are associated with development at the key urban centres of Lewes, Liss, and Petersfield (the Flood Zones, surface water flood risk extents and SuDs suitability for these centres is mapped in Figures 5.12 to 5.20. At this stage, detailed site boundaries are not available for these strategic developments. As these strategic developments are realised from broad locations to detailed sites, for the potential sites to be taken forward they will need to pass the Sequential Test.

Table 5.3 lists all accepted SHLAA sites at the time of writing (November 2014) and those awaiting decision, grouped by local authority and then listed in sequential order of lowest flood risk to highest flood risk. Sites in Table 5.3 shown as being located in lower risk Flood Zones should be developed in preference to sites located in higher risk flood zones. The ranking puts the greatest weight on site location, in relation to Flood Zones 3 and 2 designation - with the mapping of surface water flood extents and of the risk of groundwater flooding being used to provide further detail. Risk from sewers and artificial sources have not been included in the ranking, and should be assessed as part of a detailed site specific FRA prepared by the developer.

The SDNPA will need to demonstrate a clear and pragmatic approach to undertaking the Sequential Test. As potential sites for residential development, the development type for these sites is classed as "More vulnerable' by NPPF. On a strategic level, the SDNPA will need to use an appropriate 'area of search' when using this information to undertake the Sequential Test, so as only to compare available sites within a reasonable proximity to the site in question. At the strategic scale the area of search should be based on Housing Market Areas (HMAs) [38]. The site in question should be considered against other 'reasonably available' sites within the area of search to ensure that at the time of assessment it is the most appropriate development location. Paragraph 101 of NPPF states: *"Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding."* In addition, Stage 2 of the Sequential Test guidance produced by the EA provides further guidance on defining an area of search:

- This may be a local planning authority area, but may be reduced where justified by factors such as the function of the development or the objectives of a local plan. Examples of justifications include a local need

[36] https://www.gov.uk/flood-risk-standing-advice-frsa-for-local-planning-authorities
[37] http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/static/documents/Sequential_test_process_4.pdf
[38] A 'Strategic Housing Market Assessment' (SHMA) is currently (November 2014) in preparation for the SDNPA.

for affordable housing, town centre renewal and regeneration for which the area of search should encompass a tighter geographical area.

- In undertaking the test, sites will need to be compared in terms of flood risk, local plan status, capacity, and constraints on delivery (availability, policy restrictions, physical problems or limitations, impacts of the development, and future environmental conditions that will be experienced by the inhabitants of the development.

- In some situations, application of the test will be required in situations where there are multiple sites with similar flooding characteristics. For example, the test is being applied within an area of search that includes three sites wholly in Flood Zone 3. In this situation, in order to apply the sequential test a better understanding of the level of flood risk at each site will be required. Examination of Table 5.3 indicates that this situation is likely to arise in Lewes and, to a lesser degree at Petersfield, and the following recommendations are made:

    - At Lewes (Figure 5.12), there are 10 SHLAA sites wholly or nearly entirely in Flood Zones 2 and 3. For these sites, the Sequential Test should be applied rigorously in the first instance. Only if no other sites are available to meet the required housings needs in and around Lewes a more detailed assessment of flood risk would be required to distinguish between the sites in terms of flood hazard – i.e. flood frequency, depth, velocity, speed of onset of flooding and hence flood hazard. It is recommended that these sites are assessed in a Level 2 Lewes specific SFRA. Examination of the Lewes District SFRA (prepared in 2009), indicates that these model outputs were produced by a consultant as part of this study, the ten current SHLAA sites were not though assessed at this point in time. It is recommended that this data is obtained and reviewed for suitability, and used to inform a SDNPA Level 2 SFRA for Lewes;

    - The SDNPA and Lewes District Council should continue to develop their planning policy to detail the means and provide the justifications for the regeneration of brownfield areas of Lewes at risk of flooding (such as Spatial Policy 3 for the North Street area). Setting out clear policies and agreeing a program of enabling measures with the Environment Agency will be key to successful, sustainable developments that balance the high level of flood risk with the regeneration and development needs of Lewes; and

    - For all five SHLAA sites at Petersfield (see Figure 5.14), the majority of each site's area is in Flood Zone 1, each site has a similar narrow strip of land that lies within Flood Zones 2 and 3. On the basis that development will be allocated to the area of each within Flood Zone 1 only, the need for a comparative assessment of flood risk can be avoided.

Table 5.3 summarises the various types of flood risk that each accepted SHLAA site could be subject to. The individual flood types are colour-coded using the traffic light system and the site reference is colour-coded using the most severe level of assessment.

Table 5.3 Accepted SHLAA sites at outline stage

Rank	Site Reference	Site Description	Local authority	Locality	Yield	Fluvial FZ 1	Fluvial FZ 2	Fluvial FZ 3	Tidal flood risk	Groundwater flood risk†	Surface water flood risk
1	AR021	Well Cottage/Priory Cottage/Crossways, Cross Lane	Arun	Findon	7	yes				No risk	very low
2	AR013*	Land to the Rear of Pony Farm Training Stables	Arun	Findon	TBC	yes				No risk	very low
3	AR010	Soldiers Field Yard, Nepcote Lane	Arun	Findon	6	yes				No risk	low
4	AR018	Soldiers Field House, Soldiers Field Lane	Arun	Findon	5	yes				No risk	low
5	AR020	Findon Towers	Arun	Findon	7	yes				No risk	low
6	AR015	Findon Manor Hotel, High Street	Arun	Findon	12	yes				No risk	high
7	AR008	Roger's Farm Garden Centre and former allotments	Arun	Findon	8	yes				No risk	high
8	CH128	12 Park Crescent, Midhurst	Chichester	Midhurst	10	yes				< 25%	very low
9	CH133	Former Garden to West Lavington Hill House	Chichester	Midhurst	10	yes				< 25%	very low
10	CH135 (a)**	Tripp Hill Farmhouse Paddocks, Lower Horncroft	Chichester	Fittleworth	5	yes				< 25%	very low
11	CH085	Garage Site at Martlett Road	Chichester	Petworth	5	yes				< 25%	very low
12	CH110	Garage Site at Parsonage	Chichester	Rogate	6	yes				< 25%	very low
13	CH022	Garage site at Old Glebe	Chichester	Fernhurst	5	yes				< 25%	very low
14	CH111*	Land to the south of London Road	Chichester	Rake	TBC	yes				< 25%	very low
15	CH135 (b)**	Tripp Hill Farmhouse Paddocks, Lower Horncroft	Chichester	Fittleworth	TBC	yes				< 25%	very low
16	CH032	Land at Fleet Cottage, The Fleet.	Chichester	Fittleworth	5	yes				>= 25% <50%	very low
17	CH100	Land South of 13 Rothermead	Chichester	Petworth	8	yes				>= 25% <50%	very low
18	CH118	Land South of Lopper Ash	Chichester	South Harting	8	yes				>= 50% <75%	very low
19	CH125	Land South of Heather Close	Chichester	West Ashling	30	yes				>= 75%	very low
20	CH025	Fernhurst Glebe	Chichester	Fernhurst	13	yes				< 25%	low

Rank	Site Reference	Site Description	Local authority	Locality	Yield	Fluvial FZ 1	Fluvial FZ 2	Fluvial FZ 3	Tidal flood risk	Groundwater flood risk†	Surface water flood risk
21	CH062	84a Petersfield Road	Chichester	Midhurst	40	yes				< 25%	low
22	CH090	Laundery Cottage and land to North	Chichester	Petworth	7	yes				< 25%	low
23	CH094	Square Field	Chichester	Petworth	70	yes				< 25%	low
24	Ch061	Garage site at New Road,	Chichester	Midhurst	5	yes				< 25%	low
25	CH104	Land at Parsonage	Chichester	Rogate	5	yes				< 25%	low
26	CH063	Former Allotment Land, West of Easebourne	Chichester	Easebourne	14	yes				>= 50% <75%	low
27	CH027	Lower Nappers Farm	Chichester	Fernhurst	7	yes				< 25%	medium
28	CH098	Land at Woodlea, Northmead	Chichester	Petworth	13	yes				< 25%	medium
29	CH088	Land East of Hampers Common Industrial estate	Chichester	Petworth	35	yes				< 25%	high
30	CH075	Land at Luffs Meadow	Chichester	Northchapel	8	yes				< 25%	high
31	CH146	East of Littlecote (Rotherlea)	Chichester	Petworth	25	yes				< 25%	high
32	CH096	Land North of Northend Close	Chichester	Petworth	20	yes				>= 25% <50%	high
33	CH092	Land to the rear of Rothermead	Chichester	Petworth	5	yes				>= 25% <50%	high
34	CH115*	Manor Farm	Chichester	Singleton	TBC	yes				>= 50% <75%	high
35	CH134	Land at Holmbush Way	Chichester	Midhurst	6	yes	yes***			< 25%	high
36	EA001	Holt Leigh House, Back Lane, Bucks Horn Oak	East Hampshire	Bucks Horn Oak	9	yes				< 25%	very low
37	EA002	Land at Clements Close, Binstead	East Hampshire	Binstead	10	yes				< 25%	very low
38	EA070	Land West of Bell Hill, Petersfield	East Hampshire	Petersfield	28	yes				< 25%	very low
39	EA116	Land to North of Reservoir Lane	East Hampshire	Petersfield	11	yes				< 25%	very low
40	EA108	Lower Tilmore, Tilmore Road, Petersfield	East Hampshire	Petersfield	5	yes				< 25%	very low
41	EA043	Kippences, Farnham Road/ Station Road, Liss	East Hampshire	Liss	30	yes				>= 25% <50%	very low
42	EA115	Community Centre, Love Lane	East Hampshire	Petersfield	10	yes				>= 25% <50%	very low
43	EA005	Land at Greenways and Kiln Lanes	East Hampshire	Buriton	5	yes				>= 50% <75%	very low

Rank	Site Reference	Site Description	Local authority	Locality	Yield	Fluvial FZ 1	Fluvial FZ 2	Fluvial FZ 3	Tidal flood risk	Groundwater flood risk†	Surface water flood risk
44	EA022	Liss Forest Nurseries, Petersfield Road, Greatham	East Hampshire	Greatham	34	yes				>= 50% <75%	very low
45	EA101	Land at Park Farm, Blanket Street, Worldham	East Hampshire	Worldham	10	yes				No risk	low
46	EA064*	Land off Waterworks Road	East Hampshire	Petersfield	TBC	yes				< 25%	low
47	EA051	Land at Buckmore Farm,	East Hampshire	Petersfield	73	yes				>= 25% <50%	low
48	EA034	Land at Inwood Road, Liss	East Hampshire	Liss	25	yes				< 25%	medium
49	EA055	Land South of Durford Road, Petersfield	East Hampshire	Petersfield	48	yes				< 25%	medium
50	EA057	Land in High Street, Dragon Street and St Peter's Road	East Hampshire	Petersfield	19	yes				>= 25% <50%	medium
51	EA097	Land East of Hays Cottages, Steep	East Hampshire	Steep	10	yes				< 25%	high
52	EA038	Land at Hilliers Nurseries, Andlers Ash Road, Liss	East Hampshire	Liss	100	yes				>= 25% <50%	high
53	EA112	HCC Depot off Paddock Way	East Hampshire	Petersfield	30	yes				>= 25% <50%	high
54	EA050	Land at Penns Field, Petersfield	East Hampshire	Petersfield	89	yes		yes***		< 25%	high
55	EA062	Land at the Causeway	East Hampshire	Petersfield	136	yes	yes	yes		< 25%	high
56	EA078	Land East of Pullens Lane, Petersfield	East Hampshire	Petersfield	5	yes	yes	yes		< 25%	high
57	EA054	Land at Larcombe Road, Petersfield	East Hampshire	Petersfield	71	yes	yes	yes		>= 25% <50%	high
58	EA074	Land to the west of the Causeway, Petersfield	East Hampshire	Petersfield	64	yes	yes	yes		>= 25% <50%	high
59	HO014	Land West of Besley Farmhouse	Horsham	Watersfield	5	yes				< 25%	very low
60	HO009*	Land at Silverdale	Horsham	Coldwaltham	TBC	yes				>= 25% <50%	very low
61	HO015	Land at Brookland Way,	Horsham	Coldwaltham	20	yes				>= 25% <50%	low
62	HO022*	Shoreham Cement Works	Horsham	Upper Beeding	TBC	yes	yes***	yes***	yes	>= 75%	high
63	HO011*	Houghton Bridge Caravan Site, Houghton Bridge, Amberley	Horsham		TBC			yes	yes	>= 50% <75%	medium
64	LE016	Land at North End,	Lewes	Ditchling	30	yes				< 25%	very low
65	LE014	land to the South of Wellgreen Lane	Lewes	Kingston	6	yes				< 25%	very low

Rank	Site Reference	Site Description	Local authority	Locality	Yield	Fluvial FZ 1	Fluvial FZ 2	Fluvial FZ 3	Tidal flood risk	Groundwater flood risk†	Surface water flood risk
66	LE086	Land adjacent to Sunnyside and Ouseside Cottages, Newhaven Road	Lewes	Rodmell	9	yes				< 25%	very low
67	LE060	Juggs Road	Lewes	Lewes	5	yes				>= 25% <50%	very low
68	LE059	St Mary's Social Centre, Christie Road	Lewes	Lewes	8	yes				< 25%	low
69	LE039	East Sussex County Council, County Hall, St Annes Crescent	Lewes	Lewes	100	yes				>= 25% <50%	low
70	LE036	Brooklands Yard, Southover High Street, Lewes	Lewes	Lewes	9	yes				>= 25% <50%	low
71	LE005	103a Lewes Road, Ditchling	Lewes	Ditchling	15	yes				>= 25% <50%	low
72	LE042	Lewes House site land between Walwers Lane and Church	Lewes	Lewes	35	yes				>= 50% <75%	low
73	LE057	Land and Building West of North Street	Lewes	Lewes	10	yes				>= 50% <75%	low
74	LE083	Hollycroft, Chapel Lane	Lewes	East Chiltington	5	yes				>= 50% <75%	medium
75	LE090	Land at Beechwood Lane	Lewes	Cooksbridge	12	yes				>= 25% <50%	high
76	LE055	Magistrates Court, Friars Walk	Lewes	Lewes	20		yes		yes	>= 50% <75%	very low
77	LE056	Magistrates Court car park, Court Road	Lewes	Lewes	15		yes		yes	>= 50% <75%	very low
78	LE046	Pinwell Road	Lewes	Lewes	17	yes	yes		yes	>= 75%	high
79	LE032	Clayhill Nursery	Lewes	Lewes	41			yes	yes	>= 25% <50%	medium
80	LE051	Landport Club and Garages	Lewes	Lewes	8			yes	yes	< 25%	high
81	LE035	Former Southern Water Works Site, Ham Lane, (NP)	Lewes	Lewes	60		yes	yes***	yes	>= 50% <75%	medium
82	LE050	53 Cliffe High, Street Lewes	Lewes	Lewes	7		yes	yes	yes	>= 50% <75%	very low
83	LE030	Riverside - Cliffe	Lewes	Lewes	13		yes	yes	yes	>= 25% <50%	medium
84	LE012	Land at South Downs Road	Lewes	Lewes	53		yes	yes	yes	>= 50% <75%	medium
85	LE004	Former Roche site, Bell Lane	Lewes	Lewes	14	yes	yes	yes	yes	>= 25% <50%	high
86	LE040	All in North Street Lewes	Lewes	Lewes	390	yes	yes	yes	yes	>= 50% <75%	high

Rank	Site Reference	Site Description	Local authority	Locality	Yield	Fluvial FZ 1	Fluvial FZ 2	Fluvial FZ 3	Tidal flood risk	Groundwater flood risk†	Surface water flood risk
87	LE082	North of existing Hollycroft	Lewes	East Chiltington	8	yes	yes	yes		>= 50% <75%	high
88	MI005	Land between Church Lane and A23	Mid Sussex	Pyecombe	10	yes				No risk	very low
89	WE005	Land at West Street	Wealden	Alfriston	6	yes				< 25%	low
90	WE002	Land behind The Fridays, Gilberts Drive,	Wealden	East Dean	14	yes				No risk	high
91	WE011	Former Allotment Site	Wealden	Alfriston	6	yes	yes	yes	yes	>= 50% <75%	high
92	WI031*	Land at Dodds Lane	Winchester	Swanmore	TBC	yes				No risk	very low
93	WI004	Northfields Farm	Winchester	Twyford	6	yes				< 25%	very low
94	WI005	Northfields Farm	Winchester	Twyford	48	yes				< 25%	very low
95	WI015	Floud Lane and Long Priors	Winchester	West Meon	14	yes				< 25%	very low
96	WI019*	Burlington Villa, Hill pound, Swanmore	Winchester	Swanmore	TBC	yes				< 25%	very low
97	WI021	land at Corhampton Lane	Winchester	Meonstoke	15	yes				>= 25% <50%	very low
98	WI025	Northend Lane	Winchester	Droxford	10	yes				>= 25% <50%	very low
99	WI013*	Townsend, North Lane, Droxford	Winchester	Droxford	TBC	yes				>= 25% <50%	very low
100	WI035	Itchen Abbas House	Winchester	Winchester	8	yes				>= 50% <75%	very low
101	WI045*	Land at Abbots Worthy House	Winchester	Winchester	TBC	yes				>= 50% <75%	very low
102	WI020	Northfields Farm	Winchester	Twyford	10	yes				< 25%	low
103	WI028	Land at 'The Old Grain Store' & 'The Long Barn' off Lippen Lane	Winchester	Warnford	6	yes				>= 25% <50%	low
104	WI001*	Land adj to Swanmore Primary School and Church Car Park	Winchester	Swanmore	TBC	yes				No risk	high
105	WI036*	Little Vicarage Farm, Vicarage Lane	Winchester	Swanmore	TBC	yes				No risk	high
106	WI034	Dykes Farm, Easton Lane	Winchester	Winchester	45	yes	yes***			>= 75%	high
107	WI009	Meadow House, West Meon, Petersfield, GU32 1LS	Winchester	West Meon	5	yes	yes	yes		>= 25% <50%	high
108	WI040	Hoe Road Sports Ground	Wnchester	Bishops Waltham	45	yes				< 25%	low

Rank	Site Reference	Site Description	Local authority	Locality	Yield	Fluvial FZ 1	Fluvial FZ 2	Fluvial FZ 3	Tidal flood risk	Groundwater flood risk†	Surface water flood risk
N/A	CH023*	Land at Cooksbridge	Chichester	Fernhurst	TBC	site not assessed due to site boundary not provided					
N/A	CH029*	Chase Manor Farm	Chichester	Fernhurst	TBC	site not assessed due to site boundary not provided					
N/A	EA091*	Land at Farnham Road, Sheet	East Hampshire	Sheet	TBC	site not assessed due to site boundary not provided					

† Groundwater flood risk expressed as the proportional area that is prone to groundwater emergence in the 1km square the site falls into. Where a site straddles more than one grid square the highest risk category was chosen, as long as a substantial (greater than 10 percent) part of the site falls into it.

* Sites that have not yet been confirmed as SHLAA sites.

** Given as one development site but split into two shapes in GIS. Yield for entire site given as 5. Split unknown.

*** The portion of the site in Flood Zone 2 or 3 is limited compared to the size of the site, such that the expected scale of development can be directed towards the low risk areas within the site.

Exception Test

The NPPF Exception Test is applied to a site once it has satisfactorily passed the Sequential Test. The Exception Test recognises that there will be some exceptional circumstances when development within higher risk zones is unavoidable. NPPF states the two components of the Exception Test:

1. *"it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and*

2. *a site-specific flood risk assessment must 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."*

For Part 1, 'wider sustainability benefits', the accompanying NPPF guidance[39] details how this should be demonstrated. For this component of the Exception Test to be satisfied the proposed development will need to score positively against the aims and objectives of the SDNPA's Local Plans and the relevant measures set out in the Sustainability Appraisal. Development proposals that fail to demonstrate this should be refused unless appropriate planning conditions/obligations can be secured. A net sustainability benefit to the community is provided if the development contributes to measures such as: supporting the vitality, economy and regeneration of an area; provides facilities required by the community, if it involves redevelopment of a brownfield site/or a site in close proximity to existing settlement centres; and if unacceptable environmental impacts are minimised, and a net improvement is provided. This should be considered against a context where the development design demonstrates that flood risk will not be made worse (see Part 2) and hence reduce sustainability in flood risk terms.

Part 2 of the Exception Test, is a broader point. Whilst the sequential approach will have been applied in the process of selecting the site, this approach should not stop there. Under the Exception Test, the approach should be continued to best layout a site sequentially to direct the most vulnerable uses on the parts of the site at lowest risk from flooding. The entire approach to bringing the site forward for development should centre on minimising flood risk from the outset, it should not simply be a bolt on to a predetermined development proposal. Flood risk aware design should firstly seek to manage flood risk through avoidance through the site master-planning process, measures such as flood resilience (options such as raising of individual ground floor levels, understorey car parking areas) should then be utilised, followed by flood resistance (accepting a development will flood and using materials/designs to allow a quick recovery). Together this process should be used to design a safe development suitable for the vulnerability of its users. This will need to be demonstrated in a site-specific FRA, which should also demonstrate:

- The development will not increase flood risk elsewhere and where possible help to reduce flood risk;
- Provision of safe access and egress (see further guidance in Table 5.4);
- The use of SuDS (section 5.2.4);

[39] http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/demonstrating-that-the-wider-sustainability-benefits-to-the-community-outweigh-flood-risk-to-satisfy-the-first-part-of-the-exception-test/

- Design, implementation and operation of flood defence infrastructure as well as funding arrangements; and
- Site resident/user awareness and the provision of flood warnings.

To support application of the Exception Test, the developer of a site may need to obtain further information on flood risk – from a Level 2 SFRA if prepared (for example the Level 2 SFRA prepared for Lewes in 2009), from the EA if available, or by undertaking their own hydraulic modelling. The modelling will need to provide information on flood frequency, depth, velocity and speed of onset and allowing for the effects of future climate change on flood risk. It is recommended that this information is prepared by the SDNPA for Lewes in an area-specific Level 2 SFRA for the 10 identified SHLAA sites to a) support the Sequential Test, and b) to support the Exception Test as recommended by para. 8 of the NPPF technical guidance. This is particularly important at Lewes, as the flood risk situation is relatively complex (combined tidal/fluvial risk on the River Ouse and the presence of flood defences), and one modelling exercise will provide suitable data for the assessment of multiple sites. This scale of modelling is onerous in support of a single site, and providing the information of a strategic level reduces the potential for development blight by enabling development at these sites and managing future windfall sites.

In assessing a FRA the SDNPA should expect a satisfactory demonstration that flood risk elsewhere will not be increased. The exact details of this will be dependent on the source and magnitude of the risk and the development context. Proposals should avoid land raising (without appropriate floodplain compensation), or redirecting flows (via land re-profiling, demolition/erection of linear built environment features). For major developments, and those including the provision or modification of flood defences, hydraulic modelling will be required. Where floodplain compensation is included, supporting calculations should be included, and these should detail the provision of level-for level compensation. Level-for-level compensation provides the same volume of replacement floodplain storage at the same elevation as the volume of storage that is being lost, and should be calculated for 0.2m deep bands. If compensation is not level-for-level the replacement flood storage may have already been filled with flood water at the start of event, and in fact provide no compensatory storage when it is actually required at the peak of a flood event. For larger floodplains/defended areas, the volume of storage lost by the footprint of a building is often considered to be minimal compared to the overall volume. However, for extensive buildings, or small floodplains/defended areas the impact of the loss of storage and its impact on water levels needs to be considered. Table 5.4 provides further details on situations where floodplain compensation is required. Opportunities to reduce surface water runoff and the utilisation of SuDS should be included.

Windfall Sites

For windfall sites the Sequential and Exception Tests will need to be carried out by the SDNPA, when a developer requests this as part of the site flood risk assessment process. Windfall sites are sites not previously identified in the local plan process that have unexpectedly become available. These sites will need to be assessed on an appropriate basis as and when they come forward. The basis will need to consider the relevant planning and flood risk guidance at the time, and compare the sites against other sites considered reasonably available at that time, and within an appropriate area of search. The SDNPA will need to define this area of search, which will be based on settlement boundaries or correspond to parish areas as appropriate. The area of search will hence define the number of comparison sites on a case-by-case basis depending on the nature/location of the windfall site. Table 5.2 provides a guide to how windfall sites should be ranked in terms of flood risk, the same process as for previously planned sites

should then need to be undertaken. Careful application of the test will be required in some existing developed areas for sites at notable risk of flooding (for example areas of Lewes). A balance will need to be struck between avoiding urban blight, and prioritising the development of lower risk sites. If less-vulnerable development types appropriate for the flood risk at a given site cannot be progressed for the site in question, and subsequently, the Sequential Test is undertaken and concludes that a site at risk of flooding should go forward for development, then a rigorous application of the Exception Test will be required. Careful planning of the site layout and incorporation of measures to minimise the risks from flooding and the safety of occupiers will need to be demonstrated by the supporting FRA.

The developer should consult with the SDNPA on application of these tests at an early stage in the preparation of proposals. At this stage the developer will need supporting flood risk information, which may initially be the EA's Flood Zone mapping, but for sites with a greater risk of flooding will include more detailed flood risk information on flood frequency, depth, velocity, rate of onset. The consultation will then allow the requirements for these tests to be established against the context of the proposed development and the nature of flood risk at the site. The SDNPA will need to be ready to define the terms of the sequential test (area of search and alternative reasonably available sites), and to guide the assessment of the proposals against the aims and objectives of the local plan, to confirm sustainability/wider benefits.

Section 5.2.3 describes how flood risk can be managed through development design. Further guidance on FRA scope is provided in section 5.2.5.

Consideration of Climate Change

Managing climate change and the associated heightened floodrisks are key components of NPPF. Site specific FRAs should take into account climate change, for at least the next 100 years for residential development, unless there is a specific justification for considering a shorter period and upon agreement with the SDNPA and the EA. For non-residential development the lifetime depends on the characteristics of that development and should be assessed by the planners based on the anticipated lifetime of the development. The SDNPA should ensure that the latest climate change guidance, relevant to each type of future development is utilised in the design of that development.

The EA has published (September 2013) guidance on climate change allowances for FRAs[40] to support the requirements of NPPF. This details allowances for sea-level rise, increases in river flows and increases in rainfall intensity over various time horizons to 2115. These allowances should be incorporated in FRAs to ensure appropriate assessment of the impacts of climate change. These allowances are based on the older (2006) Defra FCDPAG3 climate change guidance, but remain the correct climate change allowances (at the time of writing - November 2014[41]) for development under the Town and Country Planning Act (1990).

- **Sea-level rise:** the calculated increase in sea-level over the development lifetime should be added to the selected design event (extreme tide level). Design sea levels (base year: 2008) alongside more detailed

[40] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296964/LIT_8496_5306da.pdf
[41] The recommended guidance on allowances may change in future (to incorporate the UKCP09 approach), and should therefore be agreed with the EA/LLFA at the start of any flood risk assessment exercise.

guidance are available from the EA as outputs of 'SC060064/TR4: Practical guidance design sea levels' study; [42]

- **River flows:** for Main Rivers, the EA may hold modelling data including for climate change. Where hydraulic modelling is being carried out, the correct climate change allowance should be factored into model inflows; and

- **Rainfall intensity**: the correct allowance for an increase in rainfall intensity should be factored into the assessment of surface water flood risk – in the modelling of a development's SuDS system, and for strategic urban drainage and surface water management studies.

The UK Climate Projections (UKCP09) [43] has more recently produced a range of climate change estimates and allowances, which are now being used in the planning and design of certain developments such as infrastructure (including flood defences). The UKCP 09 projections are more probabilistic, considering a wider range of climate change scenarios, and provide outputs at a higher resolution than previously available. In addition, new accompanying guidance on Adapting to Climate Change was issued by the EA in 2011 for use by Flood and Coastal Management Authorities. This guidance should be used by risk management authorities for flood and coastal erosion risk management design and planning.

The extent of Flood Zone 2 shows the extent of tidal and fluvial flooding with a 1 in 1,000 year chance of occurring. The Flood Map for Surface Water shows areas at risk from flooding in a 1 in 1,000 year storm in its 'Low' risk category. Mapping is provided in section 5.1.2. Whilst the outline of these areas can give an indication of the areas that might become at risk in the future under the increasing influence of climate change this approach should be applied with caution. Where there are constrictions on a narrow floodplain, flood levels including for climate change can increase substantially; similarly in flat areas the extents of the area at risk can increase well beyond the existing flood extents. Detailed hydraulic modelling is therefore preferred, and is the only method to accurately establish the impacts of climate change on flood levels.

5.2.3 Flood Risk Management through Design

This section only applies to development within Flood Zones 2 and 3 and is designed to guide the SDNPA on the types of measures that can be incorporated within developments in these Flood Zones. As outlined in section 5.2.2, all of the currently undeveloped Flood Zone 3 is designated 'Functional Floodplain'. This designation should be observed as part of any development proposal, until more detailed information is available to determine whether a site is in Flood Zone 3a or 3b. Any development within Flood Zone 3 must be supported with hydraulic modelling which assesses the flood hazard, depths and velocities associated with a range of return periods up to and including the 1 in 100 year plus climate change return period. The hydraulic modelling should define the extent of Flood Zone 3b. The requirements of the modelling should be agreed with the SDNPA and the EA in advance.

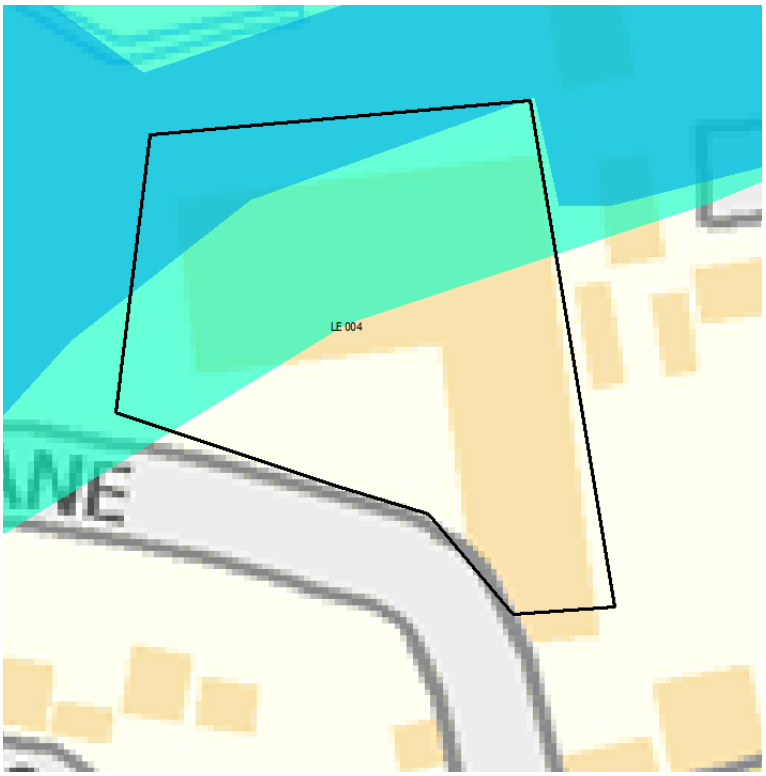
[42] This approach is only valid for the open coast. For locations subject to combined tidal/fluvial influence a suitable approach should be agreed with the EA.
[43] http://ukclimateprojections.metoffice.gov.uk

Only when the flood risks are fully understood and where the principal of avoidance has been first applied, should flood risk management be attempted through design – i.e. following satisfactory application of the Sequential and Exception Tests. This section of the SFRA presents flood risk management measures appropriate in Flood Zones 2 and 3. This is supplementary guidance to that provided in NPPF and PPG. In all instances where development is proposed in areas of flood risk, it is recommended that the SDNPA and the EA are consulted early in the process to establish any site specific issues and requirements. Guidance on the scope of FRAs and useful sources of additional information are provided in section 5.2.5 of this SFRA.

5.2.3.1 Site Layout

The sequential approach to the spatial distribution of land uses on site should be deployed ahead of building design solutions (PPG, paragraph 035). Figure 5.18 illustrates the sequential approach to site design in the context of flood risk for one of the SHLAA sites in Lewes which lies partially within Flood Zones 2 and 3. It can be seen from Figure 5.18 that the majority of the site lies outside the higher risk Zones 2 and 3 (shown in light and dark blue respectively). The northern part of the site falls within an area of identified risk. Comparison of a detailed topographic survey with hydraulic modelling results as part of a site specific Flood Risk Assessment may allow refinement of the predicted flood extents, however it is likely that the pattern of flood zoning will be broadly similar. Land use planning at the site level should aim to reflect the differing degrees of flood risk in the vulnerability classifications of proposed land uses (Table C.10 in Appendix C). Based on the existing flood zoning, depicted in Figure 5.18, where identified flood risk decreases from north to south, water compatible uses placed in the north of the site, less vulnerable uses occupying the Flood Zone 2 areas and any more or highly vulnerable uses being placed in the area of low flood risk in the middle and south of the site. In this instance, water compatible uses may include public open space which then performs a dual function by providing flood storage and amenity space. The location of SuDS in Flood Zone 3 should be avoided, in order to ensure that they can function during a flood event.

Figure 5.18 Example site identified in the SHLAA



Flood Zone 3 shown with dark blue overlay (Functional Flood Zone designations to be applied), Flood Zone 2 with light blue overlay. All land in Flood Zone 1 is shown with no overlay.

Evacuation Routes

Escape routes that are safe to use at times of flooding should be incorporated into site designs to facilitate safe evacuation of the site. Additional detailed modelling of watercourses may be required to provide the necessary flood levels, speeds of onset and flood hazard classifications needed to inform safe evacuation routes. Safe routes should be identified both inside and beyond the site boundary of the new development. Even where a new development is above the floodplain and is considered to be acceptable with regard to its impact on flood flows and flood storage, it should be demonstrated that the routes to and from the development are also safe to use. Safe escape routes should be intuitively designed, so that they remain logical routes of escape during a flood event. In many cases, the adaptation of the *normal* access and egress routes, so that they remain safe during a flood event, may be the preferable option. This removes the need for engineering additional access and egress routes specifically for use in flood events. The evaluation of 'safe' should be determined in consultation with the SDNPA and the EA and following a review of the Defra FD2320/TR1 [44] report which provides a classification of flood hazard and risk to people. Table 5.4 provides further guidance. Where possible, new development should aim to provide dry escape for the lifetime of the development.

[44] Defra / Environment Agency, 2005. Flood Risk Assessment Guidance for New Development, Phase 2, R&D Technical Report FD2320/TR1. London: Defra.http://randd.defra.gov.uk/Document.aspx?Document=FD2320_3364_TRP.pdf

5.2.3.2 Flood Risk Management Measures

Development in Tidal and Fluvial Flood Risk Areas

Development Controls for tidal and fluvial flood risk areas are summarised in Table 5.4. The level of compensatory storage required is dependent on the type of flood risk.

Table 5.4 Development Flood Risk Management Measures for Fluvial and Tidal Flood Risk

Development Flood Risk Management Measure	Guidance on Measure	Fluvial Undefended	Fluvial and Tidal	Tidal Undefended	Tidal or Fluvial Defended
Safe access and egress / Evacuation Routes	The FD2320/TR1 report section 7.5.3 states that 'New developments are required to provide safe access and exit during a flood'. Measures by which this will be achieved should be clear in the site-specific FRA. Safe access and exit is required to enable the evacuation of people from the development, provide the emergency services with access to the development during a flood and enable flood defence authorities to carry out necessary duties during the period of flood. A safe access or exit route is a route that is safe for use by occupiers without the intervention of the emergency services. FD2320/TR1 emphasises that a route can only be completely safe in flood risk terms if it is dry at all times. However it is recognised that this is not always practicable, necessitating more detailed analysis. ***The FRA should demonstrate**: ideally a dry route should be available (across land, or a permanent raised structure); failing this it should be demonstrated that depths/velocities across the route are compliant with the acceptable values, for the appropriate user group, as shown in Table 13.1 in FD2320/TR1. Details of the method to ensure the route is clearly marked for users, and free from hazardous submerged features should be included (i.e. trip hazards such as manholes and kerbs).*	Applicable.	Applicable.	Applicable.	Applicable.
Finished Floor Levels	Finished floor levels of more vulnerable uses should be above the predicted 1 in 100 year water levels plus climate change and inclusive of a freeboard allowance. The freeboard allowance used may be site specific and will depend on developers' discussions with the SDNPA and the EA. Freeboard is 300mm if the site is behind hard defences and 600mm if not. Ideally less vulnerable land uses should also have floor levels that do not flood and this arrangement should be sought wherever possible. ***The FRA should demonstrate**: provision of a suitable freeboard. If hydraulic modelling is available and includes a level for the 1 in 1000 year event, or includes a sensitivity test on the effect of model parameters on water levels, then ideally these flood levels should be within the freeboard allowance.*	Applicable.	Applicable.	Applicable.	Applicable.

Development Flood Risk Management Measure	Guidance on Measure	Fluvial Undefended	Fluvial and Tidal	Tidal Undefended	Tidal or Fluvial Defended
Building Footprint	If the footprint of buildings is increased post re-development without mitigation to compensate for lost floodplain storage space, flood levels will increase. Such schemes should be discussed in detail with the SDNPA and the EA. ***The FRA should demonstrate*** *that the impact can be considered to be negligible to other nearby development, or that compensation can be provided.*	Applicable.	Applicable.	Applicable.	Applicable.
Compensatory Storage	Compensatory storage will be required if the proposed development increases the built footprint in the floodplain. Depending on the type of flood risk and whether the area is defended, the resulting loss of floodplain storage may require compensation, through the lowering of land levels elsewhere within the site or immediately adjacent land as part of the development scheme. Storage should be provided on a level for level and volume for volume basis, so that the behaviour of the floodplain during a flood event remains unchanged. All proposals requiring compensatory storage should be discussed with the SDNPA and the EA.	Compensation should be provided for flood events up to and including the 1 in 100 year plus climate change event.	Compensation should be provided for flood events up to and including the fluvial 1 in 100 year plus climate change event or the tidal 1 in 200 year plus climate change event, whichever is the worst case.	Compensation is typically not required.	Compensation may be required depending on the impacts on other developments in the defended area (i.e. due to water displacement).
	The FRA should demonstrate*: an appropriate compensatory storage measure with supporting justification.*	*Level-for-level compensation*		*N/A*	*If an effect is demonstrated level-for-level compensation may be required.*

Figure 5.2 illustrates the extent of the Fluvial Flood Risk Areas and shows the location of defences. To ensure that flood risk is considered as part of a development along the banks of the EA's Main Rivers, a buffer zone along both banks has been implemented by the EA. The EA's policy is that any proposed development within 8 metres of the bank of a Main River, or 16 metres from the landward toe of any fluvial flood defence requires EA consultation. All development proposals within this zone should involve consultation with the EA.

All watercourses not classified as a Main River are termed Ordinary Watercourses (OW). Development should be set back at least 5m from the bank top to provide for future maintenance access to the OW. Works to within, or in close proximity to OWs require the consent of the LLFA (the SDNP area being covered by Hampshire, West Sussex and East Sussex County Councils, and Brighton and Hove City Council).

Development in Areas Designated as Functional Floodplain (Zone 3b)

- **Development in the functional floodplain should be avoided in line with the Sequential Approach presented in NPPF**. Only water compatible uses will be permitted providing there is no reduction on flood conveyance or flood storage. Less vulnerable, More vulnerable, and Highly vulnerable uses are not permitted in Zone 3b. Essential Infrastructure may be permitted providing the Exception Test is satisfied.

Development in Surface Water Flood Risk Areas

- **In accordance with NPPF, any new development proposed in Flood Zones 2 and 3, or on sites greater than 1 hectare, must include a site-specific FRA**, which will be reviewed by the EA. **For sites in areas with historic drainage problems a Drainage Impact Assessment should be prepared if the site area is greater than 0.25 hectares**. These Drainage Impact Assessments should be inclusive of a consideration of surface water drainage and measures to mitigate against any potential increase in run off. In addition to this, Figures 5.5 and 5.15 to 5.17 should be reviewed to assess whether the site is within a zone of potential surface water flood risk. As part of these assessments, the responsible party for the receiving sewer or watercourse[45] should be contacted to discuss the proposed method of managing surface water;

- **Site specific FRAs should consider the local drainage infrastructure in detail**. When preparing site specific FRAs the impact of blockages to any culverts along Ordinary Watercourses, and blockage surface water drains and the likely consequences should be considered. If necessary it might be appropriate to slightly raise ground floor levels to reduce potential damages. Such mitigation should be supported by evidence to demonstrate that surface water flow routes are not altered to the extent that the risk of flooding is made worse elsewhere;

- **An area identified at risk from surface water flooding** – either from flood mapping or fromhistorical records – should not be excluded from development solely on that basis. Surface water flooding can often be carefully managed and good site design may not only reduce the risk of flooding on site but helps to alleviate flooding problems downstream from the development. Such opportunities for a strategic drainage approach are being developed as part of Surface Water Management Plans; and

- **The management of runoff during the construction period** is an important consideration, particularly for large sites and details of measures to mitigate for this phase of development are required as part of an FRA. The Water Framework Directive (WFD) places specific requirements on the management of non-point source pollution such as that from construction site silts. Methods to reduce the volume of solids (and runoff) leaving the site include:

  - Phased removal of surface vegetation at the appropriate construction phase;
  - Provision of a grass buffer strip around the construction site and along watercourses;
  - The covering of stored materials;
  - Ensuring exposed soil is re-vegetated as soon as feasibly possible;
  - Protection of storm water drain inlets; and
  - Silt fences, siltation ponds and wheel washes.

[45] The water company with sewerage responsibility: Southern Water or Thames Water, or the relevant council department in the case of highways drains and Ordinary Watercourses, and the EA in the case of Main Rivers.

Basements

For new developments, it is recommended that habitable rooms in basements should be avoided in Flood Zone 3 or areas known to be at risk of groundwater flooding. Adaptation of existing properties, to include a basement for habitable rooms should be discouraged in Flood Zone 3 or where mapping shows a high risk of groundwater flooding. Basements for less vulnerable uses or non-habitable rooms must be designed with safe internal escape. Each application should be discussed with the SDNPA and the EA.

Building Design

The final step in the flood risk management hierarchy is to mitigate through building design. NPPF considers this as the least preferred option and should not be used in place of the sequential approach to land use planning on a site. Paragraph 059 of the NPPF PPG recommends the use of the 'Improving the Flood Performance of New Buildings: flood resilient construction' (2007) report [46] for guidance on improving the flood performance of New Buildings. The guide identifies a hierarchy of building design. This is set out below:

Flood Avoidance

Constructing a building and its surrounds (at site level) in such a way to avoid it being flooded (e.g. by raising it above the flood level).

Flood Resistance

Constructing a building in such a way to prevent flood water entering the building and damaging its fabric.

Flood Resilience

Constructing a building in such a way that although flood water may enter the building its impact is reduced (i.e. no permanent damage is caused, structural integrity is maintained and drying and cleaning are facilitated).

Flood Repairable

Constructing a building in such a way that although flood water enters a building, elements that are damaged by flood water can be easily repaired or replaced.

The Flood Resilient Construction Report (Department for Communities and Local Government, 2007), sets out to help the designer determine the best option or design strategy for flood management at the building site level, based on knowledge of basic flood parameters (e.g. depth, duration and frequency). These factors should be determined by the site specific FRA during the planning application process. Depending on these parameters (in particular depth) and after utilising options for flood avoidance at site level, designers may opt for a water exclusion strategy or a water entry strategy, as illustrated in Figure 5.19.

[46] Communities and Local Government, 2007. *Improving the Flood Performance of New Buildings – Flood Resilient Construction.* London: Department for Communities and Local Government.

Figure 5.19 Flexible and risk averse approaches to flood risk management and safe development

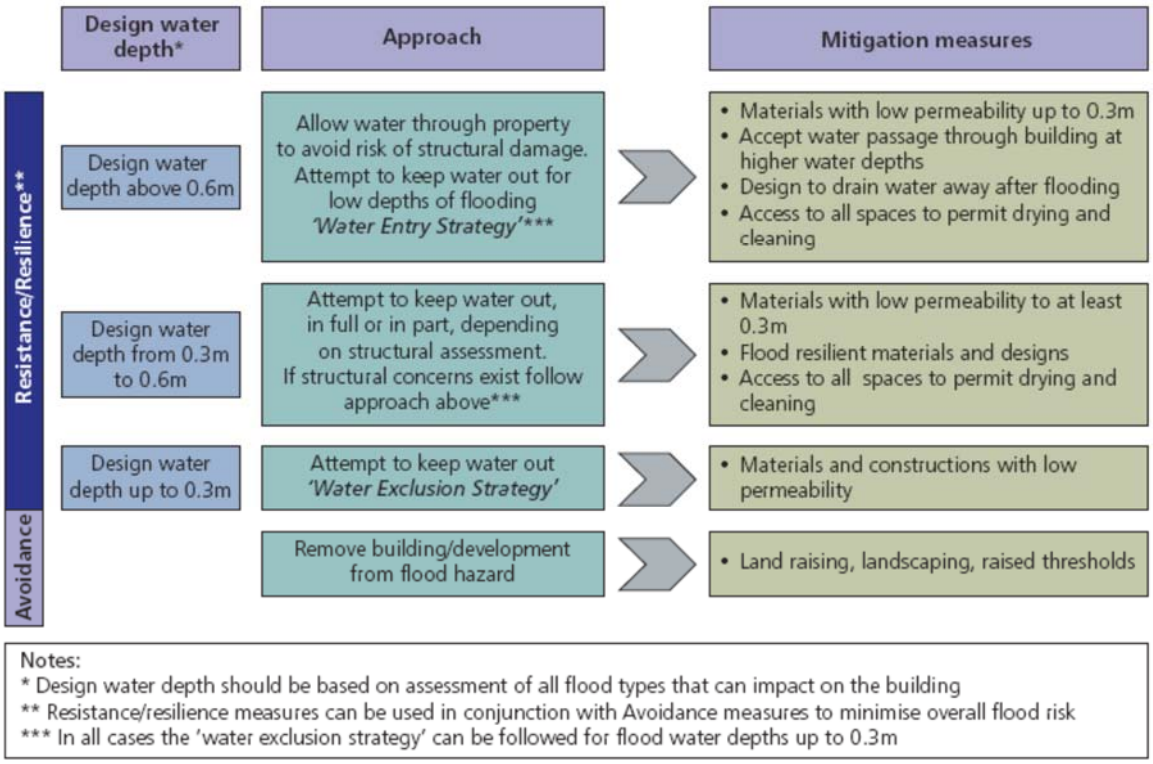


Figure Taken from 'Improving the Flood Performance of New Buildings – Flood Resilient Construction', Communities and Local Government (2007).

In a **Water Exclusion Strategy**, emphasis is placed on minimising water entry whilst maintaining structural integrity, and using materials and construction techniques to facilitate drying and cleaning. This strategy is favoured when low flood water depths are involved (up to a possible maximum of 0.6m).

In a **Water Entry Strategy**, emphasis is placed on allowing water into the building facilitating draining and consequent drying. Standard masonry buildings are at risk of structural damage if there is a water level difference between outside and inside the building of about 0.6m or more. This strategy is therefore favoured when high flood water depths are involved.

5.2.4 Sustainable Surface Water Management

This section provides guidance to the SDNPA on the range and application of measures to best manage surface water across the SDNP area. The information provided in this section should be used by the SDNPA to assess whether sufficient consideration has been given to the sustainable management of surface water associated with a proposed development. This will ensure that development within the SDNP area (such as the SHLAA sites) is delivered with effective consideration of surface water management. The information should also be used by the SDNPA when consulted on developments adjacent to the SDNP.

NPPF states that surface runoff is an important consideration in the assessment of flood risk and must be addressed at the SFRA and FRA level. Historically surface water drainage, in urban areas, utilised underground piped systems to remove excess water from the surface as rapidly as possible. The sole reliance on piped networks is now recognised as no longer the most sustainable or effective means of managing surface water. The free discharge of storm water into the piped network has the potential to increase flooding in downstream areas. Additionally, pipe systems are not designed for extreme floods (greater than the 1 in 30 year) and combined with the potential for blockage, often result in surface water flooding issues. Further more, this traditional approach creates direct pathways by which pollutants from urban areas may discharge directly into watercourses or percolate into aquifers.

The Flood and Water Management Act (2010) places a far greater emphasis on the sustainable management of surface water. Opportunities should be taken to reduce flood risk, manage water quality and provide integrated amenity and ecological benefits through the use of Sustainable Drainage Systems (SuDS) within developments.

5.2.4.1 Surface Water Management and SuDS in the National Park

NPPF requires surface runoff to not be increased post development, as this will lead to increased flood risk elsewhere. In addition to this, the SFRA recommends that in all instances, the SDNPA should encourage the provision of betterment to reduce existing run off rates and volumes. Where possible, the development should aim to reduce brownfield runoff rates back to greenfield via the use of SuDS. Infiltration SuDs should be prioritised, followed by discharge to a watercourse, and only then by discharge to a surface water sewer, discharge to a combined sewer should be the last resort. Creative site and building design should be used to incorporate sustainable surface water management measures to attenuate runoff rates and volumes.

Sites greater than 1 hectare in size in Flood Zone 1, and all development within Flood Zones 2 and 3 are covered by the legislation presented in NPPF, which requires a FRA must accompany a planning application. This SFRA also recommends that planning applications for sites over 0.25 hectares in areas of Flood Zone 1 with historic drainage problems are supported by drainage impact assessments. FRAs and Drainage Impact Assessments will need to detail how surface water is currently managed on site and how it is proposed to be managed post development. For discharges to surface water drainage assets belonging to Southern Water and Thames Water the developer should agree acceptable rates with the water company. The discharge route (e.g. surface water drains or an open watercourse) should be detailed and it is important that there is evidence of appropriate consultation with the water company, LLFA or EA to agree proposed discharge rates. These assessments should describe how current run-off rates and volumes are managed; for brownfield site development this should include details of how rates and volumes will be reduced.

Appropriate arrangements for the approval of SuDS designs, and the adoption of constructed SuDS should be made. Defra is currently (November 2014) finalising the future arrangements for SuDS approval and adoption. In the first instance developers should confirm the future requirements for SuDS with the SDNPA, the LLFA and the EA. Appropriate arrangements should also be put in place for the adoption of, and future maintenance of constructed SuDS, depending on the circumstances arrangements may need to be made with the LLFA, the water company or an agreed maintenance company.

Source Protection Zones

The EA has defined Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply[47]. SPZs are further subdivided into the following categories:

- **SPZ1** (Inner SPZ – 50 day travel time or 50 metres): designed to protect against the effects of human activity which might have an immediate effect upon the source. SPZ1 was originally based on the need to protect against biological contaminants;
- **SPZ2** (Outer SPZ – 400 day travel time or at least 25 percent of the recharge catchment area): designed to provide protection against slowly degrading pollutants;
- **SPZ3** (Catchment SPZ): covers the complete catchment area of the groundwater source; and
- **SPZ4** (Special Interest SPZ): a surface water catchment which drains into the aquifer feeding the groundwater supply (i.e. catchment draining to a disappearing stream). In the future this zone will be incorporated into one of the other zones, SPZ 1, 2 or 3, whichever is appropriate in the particular case, or become a safeguard zone.

The chalk aquifers of the South Downs are an important source of drinking water for South East England. The aquifers are protected through a high number of SPZs shown on Figure 5.10. CIRIA (2007) highlights that in these areas SuDS design will need to prevent possible groundwater contamination by preventing infiltration of contaminated run-off. At the same time, recharge will need to be retained. Section 2.5 of the SuDS Manual (CIRIA, 2007) provides guidance on the legislative requirements for SuDS draining to groundwater. It is recommended that infiltration based SuDS are avoided in areas designated as SPZs. In the outer SPZs, infiltration of roof water only may be permissible, although this separation of flows may add complexity to a site's drainage design. Early contact with the respective water company and the EA before the drainage design is progressed is recommended.

In locations where infiltration techniques are not appropriate, solutions that attenuate runoff and discharge to surface water (the fluvial water bodies or surface water sewers) will be the most appropriate alternative. Such schemes will require consultation with the sewage undertaker (Southern Water or Thames Water) to determine discharge rates and with the LLFA if to an Ordinary Watercourse, and the EA if it is proposed to discharge into a Main River.

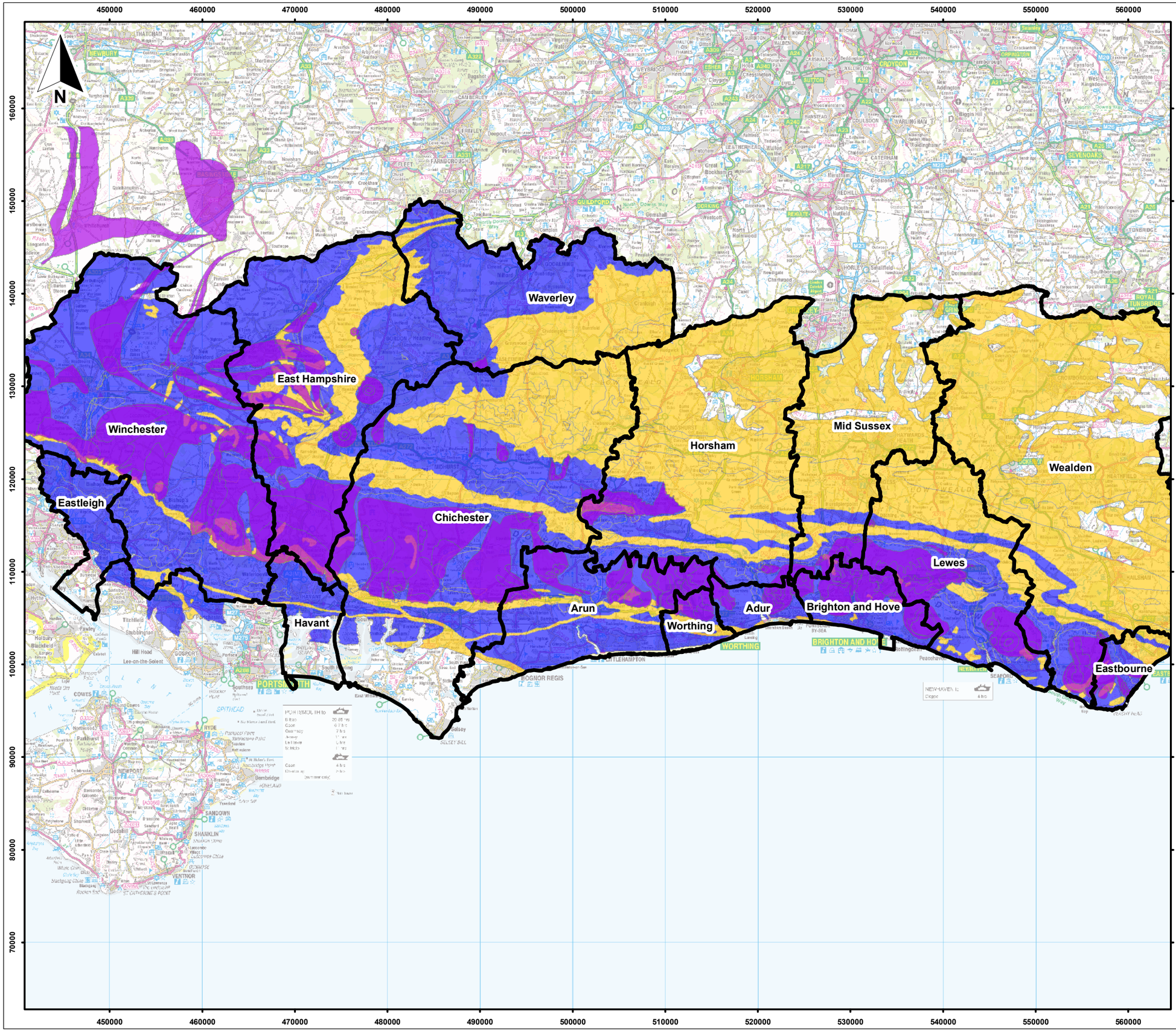
Guidance on SuDS Measures within the South Downs National Park

Infiltration based SuDS techniques are an effective solution in limited areas of the SDNP, where the geology is suitable, and where a SPZ does not prevent this method. Areas that are potentially appropriate for infiltration SuDS and the SPZs excluding use of SuDS are shown on Figure 5.10 for the National Park and Figures 5.20 to 5.22- for Lewes, Liss and Petersfield. SPZs are extensive within the SDNP and are areas where infiltration techniques should be avoided, scope remains in urban areas located outside of SPZs for infiltration techniques to be applied. The SFRA mapping does not preclude the need to undertake site specific investigations (i.e. trial pits and infiltration tests).

[47] Environment Agency, 2007. Groundwater Protection: Policy and Practice, Part 4: Legislation and Policies Public Consultation.

Consultation with the LLFA and EA should be undertaken as a matter of course. Consultation with the water company responsible for surface water drains (Thames Water or Southern Water) should be undertaken if it is proposed to connect to an existing piped network. In addition, if there is potential for SuDS to conflict with SPZs the relevant water supply company should be contacted at an early stage (Portsmouth, Southern, and Thames Water respectively). Box 5.1 details the process for selecting appropriate SuDS Techniques.

Site specific FRAs and Drainage Assessments should follow the process outlined in Box 5.1 to select appropriate SuDS. It is likely that site investigation (trial pits and infiltration tests) will be required for sites where infiltration is proposed. The SDNPA should be wary of conditioning infiltration tests to a later stage, as unsatisfactory test results often result in a scheme's SuDS strategy becoming unfeasible. Changes will be problematic at this late stage when the site masterplan has been fixed based on the requirements of other development considerations. Issues of ground contamination, ground water pollution and technical feasibility will all have to be addressed at the site specific level. There are a suite of SuDS measures and given early consideration and consultation a working solution can be designed for a given site, utilising different techniques/combinations of techniques according to the development proposal contexts.



Key:

- Local Authority boundaries
- SDNPA boundary
- Source Protection Zones

Appropriateness for SuDS based on geological conditions

- Potentially Not Appropriate
- Potentially Appropriate

0 20,000 Metres

Scale: 1:400,000 @ A3

H:\Projects\35227 South Downs Water Cycle Study\Drawings

South Downs National Park Authority Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.20
Suitability of SuDS

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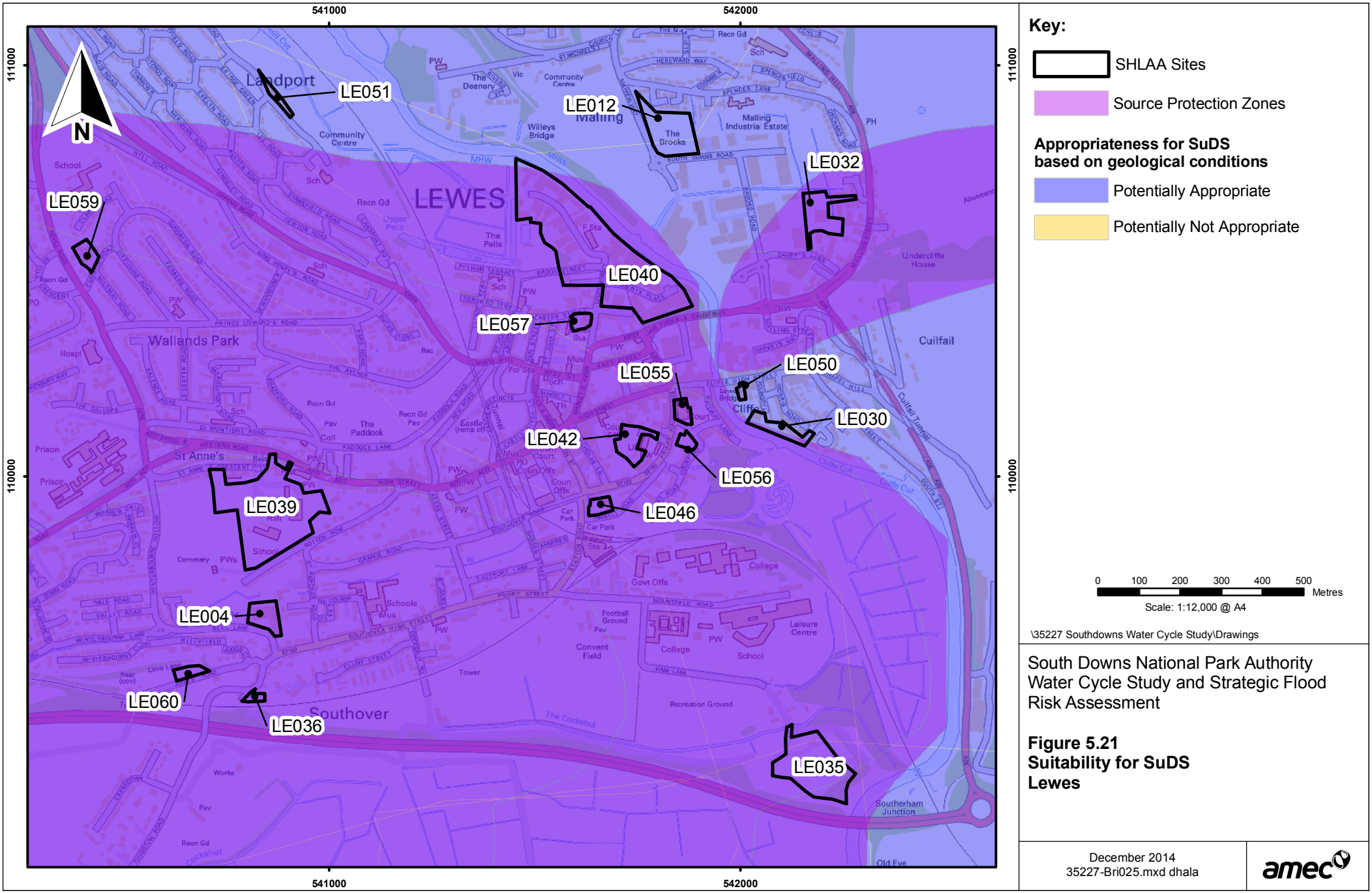

South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.21
Suitability for SuDS
Lewes

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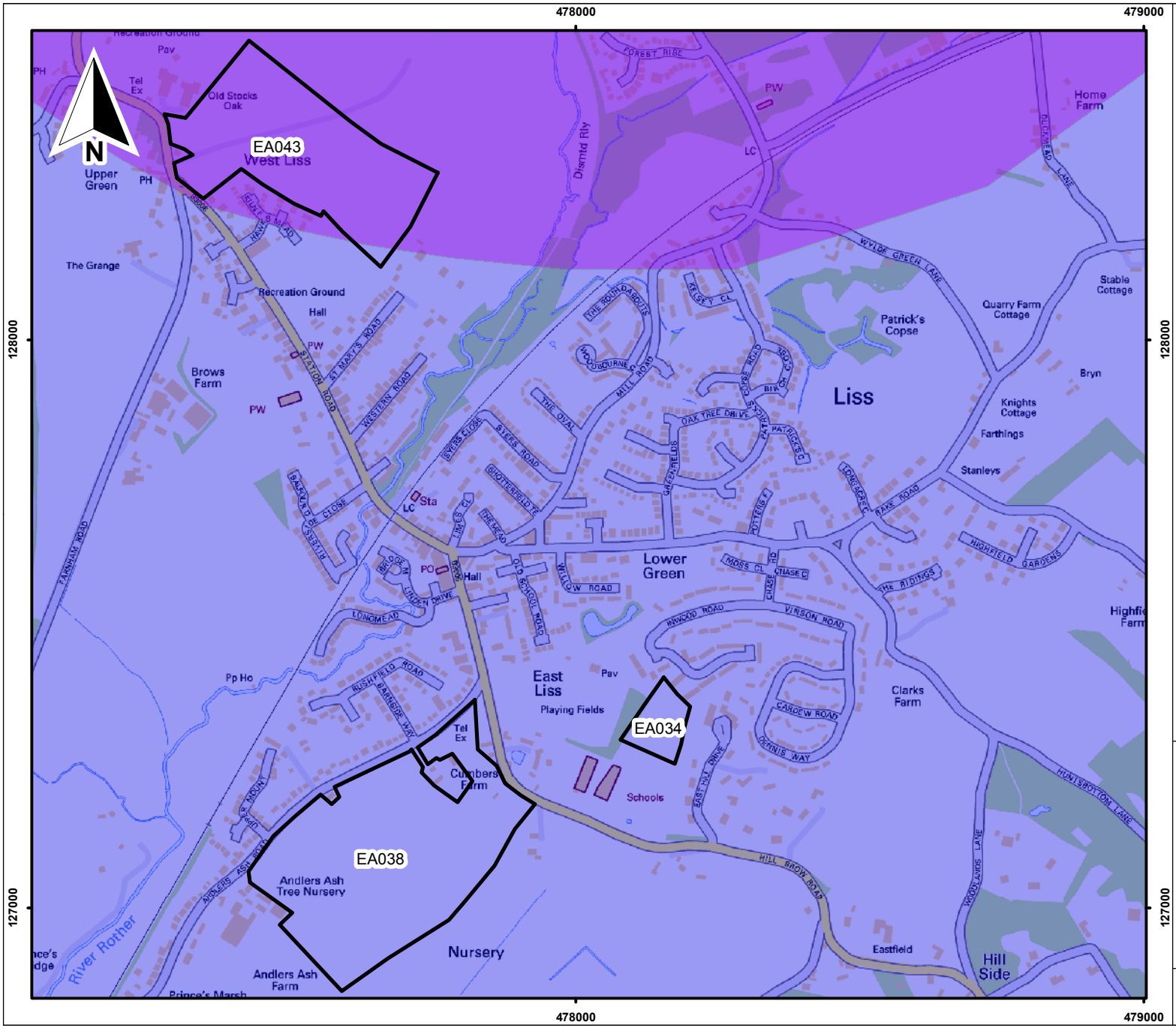

South Downs National Park Authority
Water Cycle Study and Strategic Flood Risk Assessment

Figure 5.22
Suitability for SuDS
Liss

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The SDNPA should expect to see SuDS as an integral part of developments, and the supporting FRA should provide full details of the process guiding selection of the chosen SuDS measures. The FRA should detail how the chosen SuDS manage water quantity and quality, as well as any wider benefits, such as: biodiversity and landscape. SuDS guidance such as the CIRIA SuDs Manual details a wide range of SuDS, and provides a range of design guidance, the variety of techniques mean that some level of SuDS provision should be achievable on most sites. Where no SuDS are proposed as part of a development the reasons for this should be stated and agreed with the LLFA/EA. On space-constrained sites, infiltration measures under hard standing areas provide a way of efficiently fitting SuDS within a design, swales can be used to provide attenuation along narrow strips of land, and amenity areas can be used for temporary storage. Whilst measures such as underground tanks and oversize pipes can contribute to managing runoff rates, these measures should be seen as a last resort. Table 5.5 details the SuDS Hierarchy, whereby measures that provide the greatest environmental benefit (most sustainable, top of the table) should be prioritised over less sustainable options. The least sustainable options should only be selected once other SuDS opportunities have been discounted.

Table 5.5 SuDS hierarchy

Sustainability of feature	SuDS Technique	Benefits from the SuDS Technique		
		Flood Reduction	Pollution Reduction	Landscape and Wildlife Benefit
Most sustainable	**Living roofs**	☑	☑	☑
	Basins and Ponds • Constructed wetlands • Balancing Ponds • Detention Basins • Retention Ponds	☑	☑	☑
	Filter strips and swales	☑	☑	☑
	Infiltration Devices • Soakaways • Infiltration trenches and basins	☑	☑	☑
	Permeable surfaces and filter drains • Gravelled areas • Solid paving blocks • Porous paviours	☑	☑	
Least Sustainable	**Tanked Systems** • over-sized pipes and tanks • Storm cells	☑		

A development's SuDS will be designed to a 'design event', which for residential development is the 1 in 100 year rainfall event with a +30 percent allowance for increases in rainfall intensity. The FRA should detail the measures taken in the overall site design to 'design for exceedance'. This is since, in the event of more extreme rainfall events than the design event, or a failure (such as a blockage) flows will pass overland through a site. It is simply not possible to economically design SuDS and drainage systems to cater for the most extreme rainfall events. Inaddition, for existing developed areas, the drainage system's capacity may be exceeded by even quite minor rainfall events – historic drainage systems will have deteriorated, and will have been designed to lower standards than modern systems. Consideration should therefore be given to the pathways this water will follow – these routes will be along low-points in topography and often along roads.

Relatively minor topographical features such as dropped kerbs or speed humps may control the route of flood water. Flood depths and velocities may be such that access routes become unsafe. Exceedance flows may only occur rarely, and last for a short duration, but their impacts are disproportionately large. Good design should be utilised to situate development away or above these low points and flow pathways and ensure areas of the development have safe access maintained. Where the design allows, these areas may be set aside as green infrastructure. The development's design should be such that flood risk is not increased to downstream development due to the creation of new flow pathways. CIRIA report 'Designing for exceedance in urban drainage systems' (2006) provides further guidance. The SDNPA should expect to see due consideration of the management of drainage exceedance.

Rural land management

The South Downs National Park area suffers from 'muddy floods', associated with runoff from agricultural land. This occurs when the intensity of rainfall is in excess of the ground's infiltration capacity. It is important to note that even over chalk geology, conditions may be such that surface water runoff occurs during extreme events, either through intense rainfall, or a combination of the factors above. There are significant developed areas located downslope of the SDNP in neighbouring local planning authorities, such that land management within the National Park has a major control on the level of downslope risk of surface water flooding.

Identification of the high-risk sub-catchments will allow focussed working with farmers on key specific areas to improve the management of land to reduce the risk of excessive runoff. Many of the available options are no or low cost, and others can be partly funded through existing grants/schemes. Table C.12 in Appendix C provides further information. A range of measures are available to reduce runoff rates and encourage storage and infiltration within farmland. Measures can be divided into three groups: measures that manage runoff potential at source, measures that tackle pathways and measures that increase storage before release to the main local watercourses and/or development located downslope. The measures should be viewed in two ways:

1) Reductions in peak runoff will assist in reducing flood risk via a) lower peak flows and total volumes of runoff; and b) reduced erosion and transport of soil from fields to downslope areas, reducing the siltation/blockage risk to downslope ditches and drains, and the clean-up efforts after an event;
2) A proportion of retained water (not lost via rapid runoff or subsequent evapo-transpiration) will reach watercourses and reservoirs (via baseflow and percolation), supporting river flows.

A large array of literature on runoff management technique is available. Section 3of Appendix C provides a summary of current literature and the effectiveness of key measures.

5.2.5 Scope of flood risk assessments

This section details the scope of flood risk assessment that the SDNPA should expect to see included in FRAs, and the situations that should trigger the preparation of a FRA. The decision process is shown as a flowchart in Figure 5.23. The information provided in this section should be used by the SDNPA to assess whether sufficient consideration has been given to all forms of flood risk associated with a proposed development. This will ensure that development within the SDNP area (such as the SHLAA sites) is delivered with effective consideration of flood risk. The check-lists should also be used by the SDNPA when consulted on developments adjacent to the SDNP.

Figure 5.23 Process to determine if an FRA is required

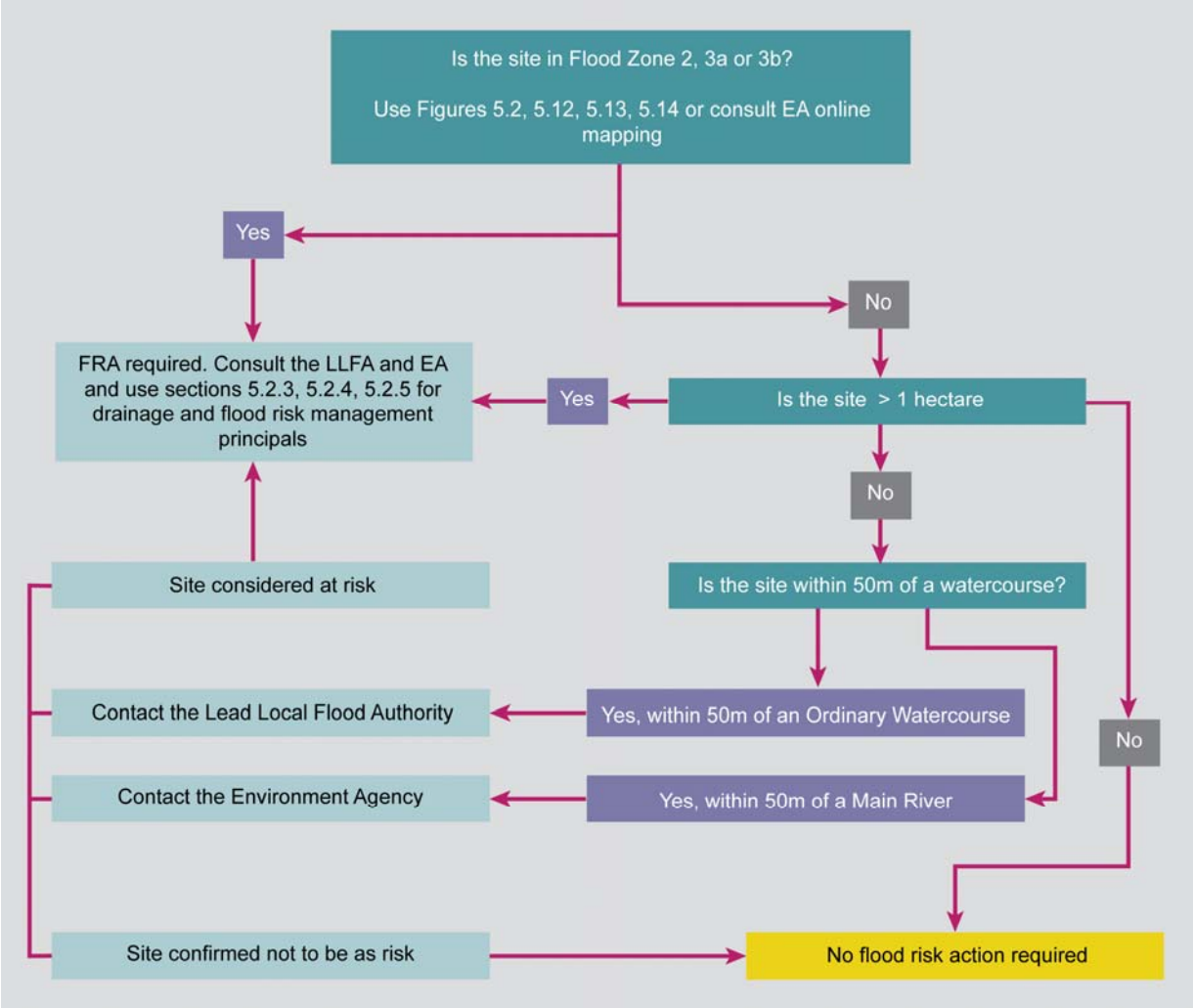


Table 5.6 lists the situations where FRAs will be required and provides signposts to further information on the scope of these FRAs. The scopes are intended to provide clear expectations of what is required in a FRA, to flag the need for discussion and consultation at an early stage. The SDNPA should use these scopes as a checklist to assess whether a FRA provides the required level of detail for a given development. Figures 5.2 and 5.12 to 5.14 should be reviewed in consultation with Table 5.2 as it defines the zones of flood risk that are referred to.

Table 5.6 Guidance on When a FRA should be Prepared

Criteria Requiring a FRA	FRA Required (Yes/No)	Scope of the FRA
Greater than 1 hectare in Flood Zone 1	Yes	See Box 5.2
In Flood Zone 2	Yes	See Box 5.3
In Flood Zone 3a	Yes	See Box 5.4
In Flood Zone 3b[1]	Yes	See Box 5.5

1: Zone 3b has not been delineated as part of this study. Assume all undeveloped Flood Zone 3 is 3b until proved otherwise.

Box 5.2 Flood Risk Assessment Scope – development greater than 1ha in Flood Zone 1

The FRA should:

- Include evidence of consultation with the relevant organisations, including the EA, the Local Planning Authority (both the SDNPA, and the district/unitary authority), the Lead Local Flood Risk Authority, the Highways Authority (County/Unitary level), and the water companies. Information on flood risk at the site from all flood sources should be sought. Discussions with the LLFA to agree the design principles for SuDS should take place at this stage. Details of existing piped drainage systems should be obtained, and discussions with the relevant water company held if it is planned to discharge water to a surface water sewer (in situations where infiltration or discharge to surface watercourses is not possible).
- Where the site is shown as being in Flood Zone 1, but is in close proximity to areas in Flood Zone 3 and 2 site levels should be checked to confirm that the Flood Zone delineation is correct.
- Confirm the level of risk posed by smaller unmapped watercourses – the EA Flood Zone maps only assess flood risk from tidal sources and from the largest watercourses (watercourses below around 3km^2 in area are rarely included in the mapping).
- Confirm the potential risk from other sources of flooding such as surface water, groundwater, piped drainage systems and raised impoundments. Across the SDNP, the chalk geology means that groundwater flooding is a key concern in some areas particularly in features known as 'dry valleys', where winterbournes may emerge during periods of high groundwater levels. Elsewhere steep slopes, or on lower permeability geology on the weald and along river valleys there can be a high risk of surface water flooding.
- Consider the impacts of climate change – will the development become at risk of flooding over its lifetime?
- Confirm that safe access/egress is possible at all times, and the site is not located on a 'dry island' that may be surrounded by flood water.
- Confirm whether the site is in a Critical Drainage Area (contact the LLFA/EA to confirm and obtain guidance).
- Consider sustainable drainage principles and maximise the use of the most sustainable types of SuDS (Table 5.5). Large sites will results in large areas of impermeable surfaces, which without appropriate SuDS to manage the runoff rates and volumes can increase flood risk downstream. The Suds should ensure that runoff is not increased. Drainage modelling should be carried out to estimate the volumes of surface water runoff and to size features to manage these volumes to an acceptable rate. Section 5.2.4 of the SFRA, and in particular Box 5.1 provide further detailed guidance on incorporating SuDS within developments in the SDNP area.
- Consider the management of drainage system exceedance in site design and layout.

The detail and complexity of the FRA will need to reflect the nature and context of the site. The FRA should include a plan of the site location, and identity relevant catchments, all watercourses and other water features (such as ponds, springs, and culverts). Topographic information should be included to allow the identification of low points and embankments that may influence the way flood water moves across the site. Surveys need to be referenced to Ordnance Datum, and should be carried out by a qualified topographic surveyor. OS levels alone are not accurate enough for assessing flood risk. Details of the proposed development should be provided, including a layout plan.

Box 5.3 Flood Risk Assessment Scope – Development in Flood Zone 2

The FRA should meet the requirements set out in Box 5.2 for developments in Flood Zone 1. In addition the FRA will need to:

- Confirm how the Sequential Test has been undertaken in selecting the site. Detail how the sequential approach has been applied with regards to laying out the development to minimise exposure to flood risk.
- For Highly Vulnerable development types (NPPF PPG Table 2) it should demonstrate the Exception Test process has been suitably applied and the development justified. Are there any opportunities to contribute to an overall reduction in local flood risk?
- Water Compatible development types are acceptable.
- Confirm the accuracy of the Flood Zone, for sites where this is based on detailed modelling, this may be a case of simply requesting flood level data from the EA and comparing it against a site topographic survey. For site's where the Flood Zones are based on basic modelling, more detailed hydraulic modelling may be required as part of the FRA to confirm flood extents. The EA and LLFA should be contacted to identify the available data, and the quality of this data, and a suitable basis on which to base the FRA.
- Consider incorporation of flood risk management through design measures (section 5.2.3).
- Confirm details of existing flood defences, their condition, standard of protection and if they will be maintained in future.
- Consider likely flood depths, velocities and the rate of onset and the order in which the site will flood. Are there any zones of high-velocity adjacent to flood defences? Confirm that flood hazard is managed, and users can safely move through the site at times of flood.

Box 5.4 Flood Risk Assessment Scope – Development in Flood Zone 3a

The FRA should meet the requirements set out in Box 5.2 for developments in Flood Zone 1. In addition the FRA will need to:

- Confirm how the Sequential Test has been undertaken in selecting the site. Detail how the sequential approach has been applied with regards to laying out the development to minimise exposure to flood risk.
- Highly Vulnerable development types (NPPF PPG Table 2) should not be placed in this Flood Zone.
- For Essential Infrastructure and More Vulnerable development types (NPPF PPG Table 2) it should demonstrate the Exception Test process has been suitably applied and the development justified. Are there any opportunities to contribute to an overall reduction in local flood risk?
- Water Compatible development types are acceptable.
- Confirm the accuracy of the Flood Zone, for sites where this is based on detailed modelling, this may be a case of simply requesting flood level data from the EA and comparing it against a site topographic survey. For site's where the Flood Zones are based on basic modelling, more detailed hydraulic modelling may be required as part of the FRA to confirm flood extents. The EA and LLFA should be contacted to identify the available data, and the quality of this data, and a suitable basis on which to base the FRA.
- Consider incorporation of flood risk management through design measures (section 5.2.3).
- Confirm details of existing flood defences, their condition, standard of protection and if they will be maintained in future.
- Consider likely flood depths, velocities and the rate of onset and the order in which the site will flood. Are there any zones of high-velocity adjacent to flood defences? Confirm that flood hazard is managed, and users can safely move through the site at times of flood.

Box 5.5 Flood Risk Assessment Scope – Development in Flood Zone 3b

If the site has been flagged as being in Flood Zone 3b on a precautionary basis due to the lack of data to sub-divide Flood Zone 3 into Flood Zones 3a and 3b, further investigations should be carried out to confirm if data is available which can be used to better delineate Flood Zone 3, or to produce this information via hydraulic modelling. **If modelling indicates the site is in fact in Flood Zone 3a, refer to Box 5.4. For sites in Flood Zone 3b:**

The FRA should meet the requirements set out in Box 5.2 for developments in Flood Zone 1. In addition the FRA will need to:

- Confirm how the Sequential Test has been undertaken in selecting the site. Detail how the sequential approach has been applied with regards to laying out the development to minimise exposure to flood risk.
- Highly, More, and Less Vulnerable development types (NPPF PPG Table 2) should not be placed in this Flood Zone.
- For Essential Infrastructure development types (NPPF PPG Table 2) it should demonstrate the Exception Test process has been suitably applied and the development justified. Are there any opportunities to contribute to an overall reduction in local flood risk?
- Water Compatible development types are acceptable.
- Confirm the accuracy of the Flood Zone, for sites where this is based on detailed modelling, this may be a case of simply requesting flood level data from the EA and comparing it against a site topographic survey. For site's where the Flood Zones are based on basic modelling, more detailed hydraulic modelling may be required as part of the FRA to confirm flood extents. The EA and LLFA should be contacted to identify the available data, and the quality of this data, and a suitable basis on which to base the FRA.
- Consider incorporation of flood risk management through design measures (section 5.2.3).
- Confirm details of existing flood defences, their condition, standard of protection and if they will be maintained in future.
- Consider likely flood depths, velocities and the rate of onset and the order in which the site will flood. Are there any zones of high-velocity adjacent to flood defences? Confirm that flood hazard is managed, and users can safely move through the site at times of flood.

In all cases, the FRA or Drainage Assessment must follow the SuDS hierarchy in the selection of an appropriate SuDS technique. A piped solution will only be acceptable if it can be demonstrated that more sustainable SuDS techniques are not feasible.

The following link to the EA provides additional information:

- Flood Risk Standing Advice for use by planning applicants and their agents: https://www.gov.uk/flood-risk-standing-advice-frsa-for-local-planning-authorities
- Guidance and forms for assessing flood risk for planning applications: https://www.gov.uk/government/publications/planning-applications-assessing-flood-risk
- Details on FRAs: https://www.gov.uk/planning-applications-assessing-flood-risk

5.2.6 Recommendations for the SDNPA Local Development Plan

The Level 1 SFRA has assessed flood risks from all sources and advocated a sequential risk based approach to managing flood risk, which is in line with the guiding principles presented for managing flood risk in NPPF, the primary objective of which is to steer new development towards areas of least flood risk. This section summarises the recommendations for consideration by the SDNPA in the spatial planning process and in the management of flood risks; it also identifies situations/events which might trigger the need to either update the SFRA or undertake additional flood risk assessment work.

Recommendations

Throughout the SFRA there are a number of recommendations relating to the management of flood risk within the SDNP. These key recommendations, for inclusion in the Local Development Plans or Frameworks, are summarised below:

- A Level 2 SFRA should be produced for Lewes. For the potential development sites, flood risk data on flood depth, velocity, speed of onset and frequency is needed to better cross-compare sites and support the Sequential Test. It should be noted that new development could assist in providing a funding mechanism to protect existing properties at risk of flooding, supporting an overall reduction in flood risk;

- SWMPs should be prepared for Petersfield and Liss. The SDNPA should work with Hampshire County Council (the LLFA) to enable these studies;

- Aim to reserve land in Flood Zone 1 for highly vulnerable and more vulnerable land uses;

- Should the SDNPA wish to allocate sites with an identified flood risk, then the policy should either be to avoid the areas of flood risk or to assess the risk in more detail through either Level 2 SFRA work or on a site specific level. This more detailed review should include identification of Flood Zone 3b and it should assess flood hazard and depth for return periods up to and including the 1 in 100 year plus climate change event;

- In the absence of a Level 2 Assessment for the wider SDNPA area, windfall sites in Flood Zones 2 and 3 should not be accepted unless they include a detailed review of potential flood risks. This should include a detailed topographic survey, and will almost certainly need to utilise the results of detailed hydraulic modelling;

- Development should not be placed in areas of sites within the 8m buffer zone along watercourses. These strips should be set-aside as open space. The development of such sites adjacent to watercourses should only be considered following the consideration of topographic data and a hydraulic assessment of the likely flood risks from these currently un-modelled watercourses;

- Manage flood risk through avoidance of risk wherever possible;

- Follow the Sequential approach advocated in NPPF and section 5.2.2 of the SFRA;

- The development and its supporting FRA should comply with the scope set out in boxes 5.2 to 5.5. this is key to a) ensuring developments upstream of the SDNP do not increase flood risk within the National Park area, and b) that developments within the SDNP do not increase flood risk downstream of the National Park area;

- An emergency evacuation procedure should be implemented for those sites which can feasibly be designed to allow for evacuation out of the flood risk zone. Evacuation procedures should be reviewed and approved by the SDNPA prior to the issue of planning consent;

- All new development should attempt to reduce surface water runoff by sustainably managing runoff on site. Flood risk must not increase post development; and

- All new development greater than 1 hectare in size and all new development in Flood Zones 2 and 3 are required to undertake a Flood Risk Assessment. In areaswith historic drainage problems, sites in excess of 0.25ha should have an acco mpanying FRA. The FRA should consider flood risk from all sources and include an assessment of climate change.

5.2.7 Triggers for Re-visiting the SFRA Process

A range of events will trigger the need for an SFRA update or additional strategic flood risk assessment. This list is not exhaustive and it is recommended that the SDNPA undertak es regular consultation with the EA so as to ensure that an up to date evidence base is maintained. The following factors may necessitate the need to update the SFRA:

- An update of the Flood Zone mapping by the EA for the SDNP area;

- A significant revision or replacement of NPPF;

- A revised SHLAA data set produces, or newly identified strategic developments result in, a significantly different set of sites to those assessed in this SFRA; and

- A shift away from the policy of ‘avoidance’ resulting in development being planned for areas of flood risk, or if development is planned in the areas adjacent to un-modelled watercourses.

6. Proposed Strategy for Development

The purpose of this proposed 'Strategy for Development' is to help the South Downs National Park Authority determine its planning policies and other planning tools that may be necessary to ensure that the proposed development is able to commence in the short term whilst being sustainable in the longer term.

This section sets out a proposed strategy to ensure that the required capacity, as defined in the 2014 SHLAA, can be delivered sustainably. The proposed strategy takes account of the pressures and constraints affecting each organisation based on discussions throughout the study. AMEC has developed a strategy containing a timeline of actions to encourage positive dialogue between the SDNPA, the Local (and County) Authorities, the water utility companies, other environmental stake holders (section 1.7.3), and developers (as the development plans mature towards implementation).

The strategy includes:

- Strategy considerations and the principles of sustainable development;
- Recommended phasing per location in relation to the water environment and infrastructure constraints;
- Supporting information on funding options; and
- Eleven specific recommendations to ensure SDNPA meets its development objectives.

6.1 Strategy considerations and principles of sustainable development

The SDNPA wants to understand if and how its proposed housing (2305 dwellings over 15 years) could be developed sustainably and wants a strategy to ensure this is delivered. A development strategy based on a relatively limited amount of information that is iterative and subject to change over time is inevitably complex. To identify a development route that is most likely to meet short term needs whilst also being sustainable in the long term the following issues need to be taken into account and considered:

Environment and infrastructure constraints:

- The extent, severity, and timing of the water environment and infrastructure constraints.

Housing requirements, flexibility, and phasing:

- The short term and longer term housing requirements;
- The existing housing development plans: how much flexibility the SDNPA has with regard to location and timing;

- The combination of greenfield and brownfield development sites will to some extent dictate the phasing of development. The SFRA identifies that development may take place across a range of greenfield and brownfield sites and makes specific reference to the implications for surface water management. Development on brownfield sites can also require remediation of contaminated land through to delivery of final housing numbers;

- Large strategic sites can take several years to develop to full capacity and so can potentially create the flexibility to enable water infrastructure services to increase capacity over time. Large scale development sites can also create opportunities to combine housing construction with water infrastructure upgrades. Typically large sites often consist of mixed use (i.e. commercial properties) but this has not been included in the development data prepared by the SDNPA;

- Phasing is therefore integral to developers' plans and the SDNPA should be prepared to maximise the opportunities this creates for flexible planning. Generally, developers seek to begin house building in areas adjacent to existing infrastructure to allow time for additional new infrastructure to be incorporated within the strategic site.

Role and responsibilities of the water utility companies:

- Under the Water Industry Act (1991) the water companies have a duty to provide public water supplies for domestic purposes, and to provide public sewer systems. However, they also have an obligation to manage customer bills by delivering a service that is cost-effective and good value for money. Ofwat is the economic regulator for the water and sewerage industry in England and Wales and the water companies are subject to asset planning controls. Water companies are willing to invest in infrastructure improvements once it is certain that investment is required. The timing of that investment is subject to the Asset Management Planning (AMP) cycles;

- When a developer wishes to proceed with a particular site, they can requisition the appropriate water company (or companies if separate for water and wastewater) to provide local network infrastructure in accordance with the relevant provisions of the Act (section 98 for sewerage and section 41 for water). The cost of this is shared between the developer and undertaker in accordance with provisions of legislation.

- Water sewerage undertakers expect that they will only be responsible for removing foul waste from new developed sites as the planning system requires surface water drainage to be managed using SuDS techniques. However, on unconfined chalk and thinly covered chalk, such as at Horndean, there are very real risks to the aquifer from infiltration. This risk must always be taken into account and could preclude the use of SUDS at some sites;

- Detailed hydraulic modelling is required to demonstrate the specific infrastructure improvements that would be needed for a specific development. Water companies are unlikely to pay to model particular sites outside of the Asset Management Planning (AMP) cycle. Developers are unlikely to agree to fund modelling where there is potential for the results to prohibit development.

Other competing demands and pressures:

- Neighbouring strategic growth plans and local non-strategic development figures and the pressure that these could also exert on the water environment and infrastructure. The Scoping Assessment identifies wider regional 'strategic' growth within 2km of the boundary and the pressure that development in those areas could exert on the environment and water infrastructure. However, the more detailed SHLAA assessment, on which this Strategy is based focuses on the area contained within the National Park boundary;

- Proposed development trajectory in comparison to historic growth rates. This is an important aspect due to the impact that growth rates can have on SDNPA planning resources to deal with planning applications. Annual development rates that differ (either significantly more or less) from historic rates could create resourcing problems;

  Historically approximately 250 new homes have been built within the National Park per year. However, according to the timing aspect of the SHLAA data the average in the first five years of implementation could be closer to 300 homes per year, dropping to 135 per year during years 6 to 10, and falling considerably to less than 30 beyond year ten. It is possible that over time new development proposals will be submitted that both increase the annual construction rate and the overall total. However, this potential additional future growth is not included within the constraints assessment. The Strategy takes into consideration the need to maintain dialogue with the water utility companies to ensure they are kept up to date.

Ability to impose 'sustainability' measures

- The ability to impose sustainability measures in development requirements can have a major impact on the influence of the Strategy. There is a direct relationship between the number of houses built (and sold) on a strategic site and the amount of financial contribution that the developers are able to offer for additional sustainability measures. Sustainable drainage and integrated water efficiency are two of the primary requirements that the SDNPA planners are encouraged to embed into planning objectives. A pragmatic approach may be needed to balance the size of the development (and developers' contributions) to the scale of sustainability measures; Developers in the South and East of England are already building homes to meet standards at level 3 of the Code for Sustainable Homes. However, Portsmouth Water have observed that homes built to level 3 in reality did not achieve the assumed target of 125 l/p/d, which water companies use for forecasting.

The water cycle study highlights a circular problem that development planners seek information on the level of constraint in order to prepare appropriate plans and the water utility companies (and regulators) require confirmation that development is definitely due to proceed before they are able to commit resources to investigating the level of constraint. All parties require some level of certainty in order to move forward and so the strategy aims to help navigate the series of steps that will help all parties through this iterative process.

Principles of sustainable development

This strategy is designed incorporating the principles of sustainable development in the UK as set out by Defra and the Sustainable Development Commission [48].

1. Living within environmental limits;
2. Achieving a sustainable economy;
3. Ensuring a strong, healthy, and just society;
4. Using sound science / evidence responsibly; and
5. Good Governance.

The following strategy aims to ensure that the South Downs Local Plan delivers the first three principles, being based on this study that provides the evidence to support the fourth principle leading to good governance.

6.2 Recommended phasing of development

Table 6.1 and Figure 6.1 show how the yield of the accepted SHLAA site s disaggregates between the Local Authorities and across the time intervals. The proposals as set out in section 4.1 concentrate development in the Lewes and East Hampshire areas. In fact, three quarters of the development in the South Downs National Park is planned to take place in the Lewes an d East Hampshire Local Authority areas. 40 percent of the total proposed development is expected to take place within these two ar eas and within the first five y ears of the development timeframe (925 dwellings out of 2305). At the moment this growth is simply a proposed plan, they are not confirmed and do not have planning permission. Consequently, there remains scope to a mend either the spatial or temporal plan if required based on the findings of this study (and other relevant studies supporting the Local Plan).

Table 6.1 SHLAA development disaggregated by area and over time

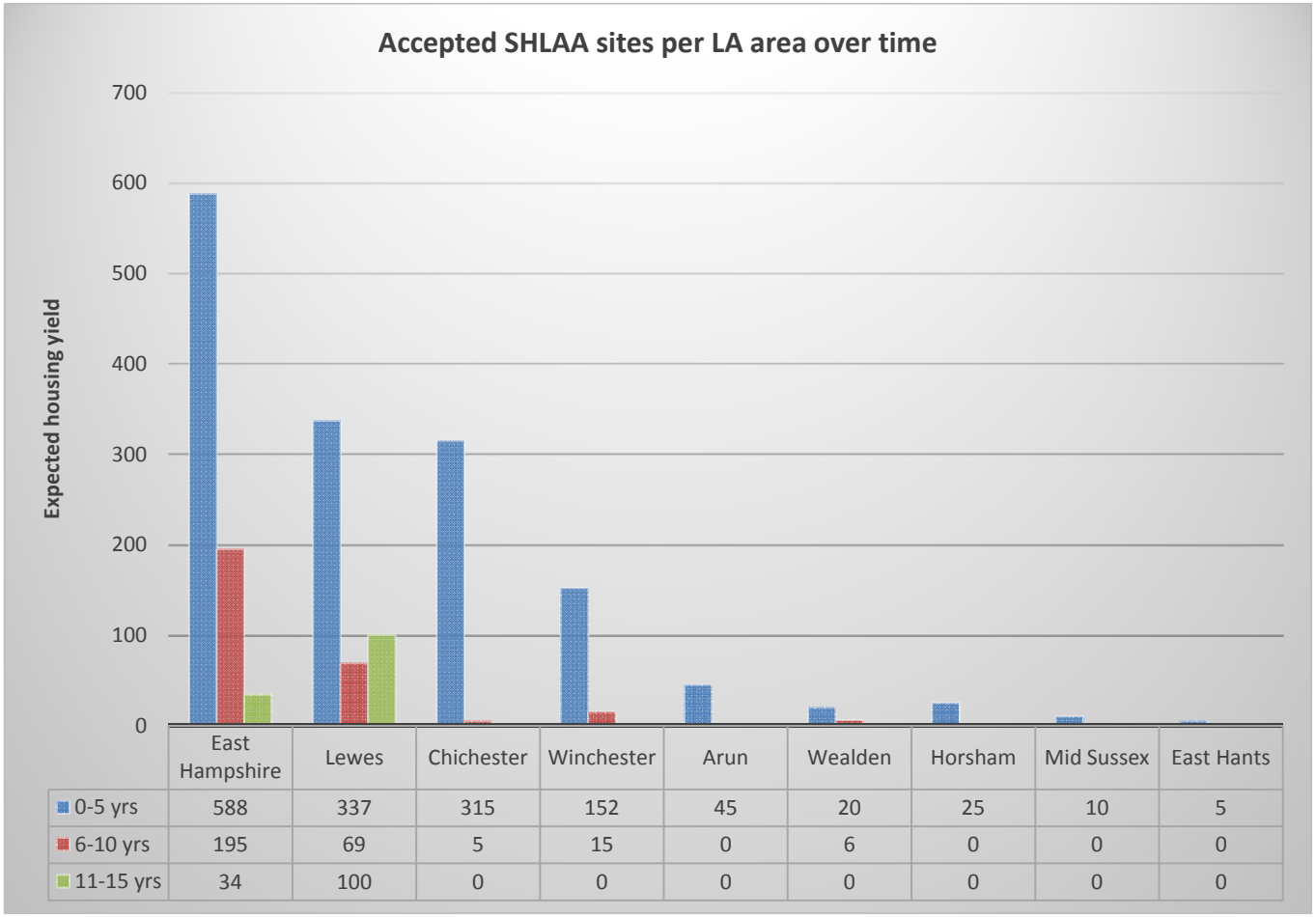
Local Authority	0-5 years	6-10 years*	11-15 years	Total	% of total
Lewes	337	453	100	890	39%
East Hampshire	588	195	34	817	35%
Chichester	315	5	0	320	14%
Winchester	152	15	0	167	7%
Arun	45	0	0	45	2%
Mid Sussex	10	0	0	10	0.4%
Wealden	20	6	0	26	1%
Horsham	25	0	0	25	1%

[48] http://www.defra.gov.uk/sustainable/government/what/principles.htm and http://www.sd-commission.org.uk/pages/our-principles.html

Local Authority	0-5 years	6-10 years*	11-15 years	Total	% of total
East Hants	5	0	0	5	0.2%
Total	1497	674	134	***2305***	
% of total	65%	29%	6%		***100%***

*Includes the 0-10 year horizon for the site/s in Newhaven East (Lewes)

Figure 6.1 Accepted SHLAA development across the Local Authority areas and over time



	East Hampshire	Lewes	Chichester	Winchester	Arun	Wealden	Horsham	Mid Sussex	East Hants
0-5 yrs	588	337	315	152	45	20	25	10	5
6-10 yrs	195	69	5	15	0	6	0	0	0
11-15 yrs	34	100	0	0	0	0	0	0	0

6.2.1 Water resources

Parts of the region are under serious water stress. However, as the water companies included growth estimates from the Local Authorities when developing their dem and forecasts, the growth proposed by the SDNPA does not represent additional growth. The South Downs growth proposals make up a very small proportion of the total demand for services in all of the water resource zones (with the exception of South East Water' s Resource Zone 5). The constraints assessment demonstrates that whilst water resources are under increasing pressure, water supplies will be secure over the next 25 years so long as a range of demand management measures are successfully implemented.

6.2.2 Supply network

The water companies have confirmed that there are no major water supply mains constraints but that there may be smaller scale local issues that emerge once SHLAA sites progress to more definite applications. This is one of a few issues that drive a re commendation for the SDNP A to e ngage regularly with the water co mpanies regarding development activity, progress, and ongoing planning. Whilst smaller scale issues may need some investment this is not expected to be outside of normal planning timescales.

6.2.3 Wastewater treatment

The Scoping Assessment highlighted major constraint s in the areas served by Tangmere and Chichester WwTWs (both located outside the National Park but potentially impacted by large strategic development sites that would be the responsibility of the SDNPA to plan – section 1.2) and also headroom issues at Alton, and Bordon WwTW (and supporting sewerage network). However, the more detailed SHLAA data indicates that no major development has yet been accepted in these areas. The ma jor issues at Tangm ere are expected to be addressed by an invest ment programme due to kick off in 2019.

All the treatment facilities in the study ar ea are subject to increasingly constrained discharge levels due to the drive to improve existing water quality from Moderate to Good by 2027 (under the WFD). The primary issue across the area is elevated phosphorous levels and this is an ongoing area of investigation.

6.2.4 Sewerage

At this point no significant constraints have been iden tified within the existing sewerage system although there are local capacity issues which Southern Water (and Thames Water) would want to model before committing to capacity statements. Modelling is generally undertaken only once development is planned and definitely going to proceed to justify the re source investment in undertaking the anal yses. However, both Southern Wate r and Tham es Water confirm that development activity does also create opportunities for them to access parts of the sewerage network for upgrade and development and that this benefit should be recognised.

The overall growth propos als put forward in Scopin g Assessment (i.e. including strategic growth sites around t he perimeter and within 2km of the National Park boundary) could be accommodated on the condition that growth rates

and confirmation of approved development is discussed with the water companies in advance. A concern that must be addressed primarily by Chichester District Council is development in the areas that the Scoping Assessment identified within the Tangmere / Chichester WwTW catchment areas.

The strategic growth put forward specifically within the National Park area can therefore also be supported by the capacity of the existing framework on the condition that development proceeds at an appropriate annual rate and with ongoing dialogue with the water companies. The most pertinent issue is to resolve sites that have been identified within fluvial flood zone 3 and / or those that would be highly vulnerable to groundwater, tidal, or surface water flooding. From the perspective of the Water Cycle Study and Level 1 SFRA the most important features of sustainable development in the South Downs National Park will be integrated water efficiency measures within new homes and appropriate sustainable drainage techniques (SuDS).

6.3 Funding Considerations

Delivering the necessary supporting water and sewerage infrastructure is critical to facilitating the envisaged residential growth in the National Park. Communities require access to water, drainage, flood defences and green infrastructure. The Barker Review [49] concluded that shortcomings in the delivery and funding of water infrastructure and services have real potential to delay housing growth. For example, it claims that this has delayed the delivery of around 40,000 dwellings in the South East of England.

Whilst the specific cost of the required water and sewerage infrastructure are investigated in detail by the water companies, the funding mechanisms and their policy implications that need to be considered further by the SDNPA and are outlined below.

6.3.1 Water industry legislation

Southern Water and Thames Water are appointed as the water and sewerage undertakers for the National Park through an appointment made under the Water Industry Act 1991. This also makes them **"specific consultation bodies"** in accordance with the Town & Country Planning (Local Planning) Regulations 2012. Water supply is provided by Southern Water, South East Water, and Portsmouth Water. The principal duties of a water and sewerage undertaker are set out in that legislation. Section 37 of that Act places a duty upon a water undertaker to develop and maintain an efficient and economical system of water supply within its area. Similarly section 94 places a duty upon a sewerage undertaker to provide, improve and extend a system of public sewers to ensure that its area is effectually drained and the contents of those sewers effectually dealt with.

6.3.2 Water industry price review

The Water Services Regulation Authority (Ofwat) is the economic regulator of water and sewerage companies in England and Wales. For every five year asset management planning (AMP) cycle, companies submit a business plan to Ofwat. The plans set out each company's view of what it needs to do to maintain its assets, improve services to

[49] The Barker Review of Housing Supply: http://www.barkerreview.org.uk

customers and deal with its impact on the environment. The funding is linked to the setting of customer bills (the so-called "price review" or PR).

Any infrastructure requirements which arise after agreement of the five year AMP will normally be considered for the following AMP period. AMP5 will cover the period 2010 to 2015. Water companies are able to submit interim determinations within the five-year planning cycle to seek additional funding for unforeseen requirements, but most plans should be covered by the normal submission process. A Water Cycle Strategy covers a longer planning period and can therefore inform longer term water company asset planning.

6.3.3 Community Infrastructure Fund

The community infrastructure levy (CIL) is a local levy that authorities can choose to introduce to help fund infrastructure in their area. The CIL regulations came into force on 6 April 2010 and give local authorities the ability to charge developers to help fund new infrastructure provision [50].

CIL enables local authorities to apply a levy to all new developments (residential and commercial) in their area, subject to a low *de minimis* threshold. Where appropriate the local planning authority could use a CIL to supplement a negotiated agreement, which may be required for site specific matters, including affordable housing.

CIL payments could be collected for the delivery of water infrastructure and for maintenance arrangements of SuDs for example, however, if a Local Authority seeks to use CIL for collecting contributions, analysis of all infrastructure requirements and costs will be required to ensure that an appropriate level of contributions is sought.

The water companies provide essential water and wastewater infrastructure in order to support growth and deliver environmental improvements. That infrastructure provision can incorporate the provision of buildings such as a new sewage pumping station or a new sewage treatment building for example. The nature of such infrastructure buildings means that there is no impact on other forms of infrastructure requirements such as schools, open space and libraries. It is therefore likely that water and wastewater infrastructure buildings would be exempt from payment of the Community Infrastructure Levy.

The SDNPA may however wish to consider using CIL contributions for enhancements to the sewerage network beyond that covered by the Water Industry Act and sewerage undertakers, for example by proving greater levels of protection for surface water flooding schemes. Sewerage undertakers are currently only funded to a circa 1:30 flood event.

Further information on the Community Infrastructure Levy is available online at the Planning Advisory Service [51].

[50] Information as updated in May 2014: https://www.gov.uk/government/policies/giving-communities-more-power-in-planning-local-development/supporting-pages/community-infrastructure-levy
[51] http://www.pas.gov.uk/community-infrastructure-levy

6.3.4 Developer Contributions

Requisitions are a means for a developer to request that a public sewer be provided to serve their development and payment would not normally be required to create additional capacity in existing public sewers.

When a request for sewerage services is raised, if it is demonstrated that there is/was no sewerage problem before development and that a specific development is the sole driver for improved services then the water company is entitled to seek payment from the developer via a "Requisition Agreement" for any additional new sewers. The amount of contribution from developers is usually linked to the number of houses that they are developing. In a nutshell the more houses a developer is permitted to build and sell the more funding they are likely to make available for additional sustainability measures.

For local infrastructure serving more than one development site, it is necessary to share costs equitably between developers. Any infrastructure requirements which arise after agreement of the five year AMP will normally be considered for the following AMP.

In the case of a dispute Ofwat has a process for handling disputes and appeals regarding the requisitioning of water mains and public sewers [52].

6.4 Specific recommendations

Eleven overarching recommendations are listed within this strategy covering both the technical and funding implications of the issues identified within this Water Cycle Study and SFRA. These are highlighted within the sections below.

RECOMMENDATION 1: SDNPA to integrate water efficiency in new homes within the development planning application system if this is not already happening. This could be covered under a wider sustainable design policy within the Local Plan which may expect homes to meet a certain minimum level of the Code for Sustainable Homes. This would therefore need to be level 3 or above to meet the water efficiency standard. Building regulations currently require adherence to 125 l/h/d and the SDNPA must enforce this and should encourage further efficiencies appropriate to the level of water stress (i.e. the lower water stress levels in areas served by Portsmouth Water may not justify higher levels of water efficiency requirement and buildings designed to deliver per capita consumption of 125l/head/day may be all that is required by the inspectors.

A study completed by AMEC for the London Development Agency demonstrated that basic water efficiency measures (6/4 litre dual flush toilets, standard rather than power showers, restrained flow bathroom taps etc.) are feasible in terms of performance and customer satisfaction, and are sufficient to enable all types of new households to reach Level 3/4 of the Code for Sustainable Homes.

At this stage the water companies have indicated that they are unlikely to support mandatory requirements across the South Downs area for developers to achieve the higher levels of efficiency that typically can only be achieved with

[52] http://www.ofwat.gov.uk/consumerissues/selflay/gud_pro_disappmainsewer.pdf

the installation of rainwater or grey-water systems as their forecasts can balance without this. Smaller scale demonstration exemplary homes are always of interest to water companies and 'sustainable' orientated developers as examples of what water efficiency is technically possible but not necessarily as models for widespread enforcement.

Changes to water efficiency standards have been recently proposed through the Government's Housing Standards Review. The Code for Sustainable Homes (CSH) will either be retired or become a voluntary scheme operated by a third party. Local authorities will not be able to require CSH compliance as part of a development. The current minimum water efficiency standard in the Building Regulations of 125 litres per person per day (l/p/d) will be retained (equivalent to CSH levels 1 / 2). A single tighter standard of 110 l/p/d (equivalent to the CSH levels 3 / 4) will be available for local authorities to choose to apply, but only where that local authority has a specific local need (such as water stress). The Environment Agency will be working with DCLG on the specific evidence that will justify this local need but would consider that the evidence presented in this Water Cycle Study should support this. It is expected that the amended housing standards will be consolidated into Building Regulations later this year. A ministerial statement will prevent local authorities from specifying any alternative local standards

The Waste and Resources Action Programme (WRAP), sponsored by Defra, has provided targeted guidance to instill water efficiency principles within construction [53]. This includes a 'business case for improving water efficiency during construction' and guidance on how to set requirements to ensure buildings are constructed adhering to water efficiency targets. It is recommended that the South Downs National Park Authority reviews this freely available information to be aware of the latest guidance and support.

RECOMMENDATION 2: It is recommended that in addition to policies for water efficiency in new buildings, the National Park Authority leads (or works in partnership with the Local Authorities) initiatives or events promoting awareness in local communities of the need to save water, for example through hosting or co-sponsoring annual events to promote water conservation. The annual Water Festival co-sponsored by Hampshire County Council (and in 2014 followed by the Staunton Water Festival [54]) is a good example. Portsmouth Water have indicated their willingness to work with the National Park to promote water efficiency through optional metering. The company also offers advice and makes available retro fit devices. The Council may choose to lead by example by employing policies to minimise the unnecessary use of resources in its own buildings, vehicles and in all its activities.

RECOMMENDATION 3: SDNPA to engage regularly with the water companies regarding development activity, progress, and ongoing planning to ensure localised supply infrastructure capacity issues are resolved prior to completing housing development. Though not a statutory consultee, Portsmouth water would welcome more engagement with SDNPA particularly on groundwater risk.

RECOMMENDATION 4: SDNPA to ensure open dialogue with Southern Water (and Thames Water) ismaintained to share data on development planning, particularly over time if the number of sites included in the existing SHLAA increases, and longer term as the growth continues to be required.

[53] http://www.wrap.org.uk/content/water-efficiency-construction
[54] www.stauntonfestival.co.uk

RECOMMENDATION 5: SDNPA to ensure open dialogue with Southern Water (and Thames Water) ismaintained to share data on development planning to ensure opportunities to combine development with sewerage infrastructure upgrades are identified and realised.

RECOMMENDATION 6: It is recommended tha t the SDNPA ensures future development applicants provide evidence that the y have c ontacted the sewerage provider to confirm there is a connection available to the foul network. Th is might be included as part of a Flood Ri sk Assessment or Drainage Impact Assessment. Local validation requirements state that a foul sewage as sessment is necess ary prior to the validation of a planning application.

RECOMMENDATION 7: The pattern of water flows and the impact on flood risk in Lewes still needs to be better understood. Before developments are granted permission a Lewes specific SFRA Level 2 should be completed and the results integrated into the development plans. Ten accepted SHLAA sites are located in FZ2 or 3 and the details of these specific sites need to be examined to ensure that the risk is either removed or appropriately mitigated.

RECOMMENDATION 8: Within Petersfield most of the accepted SHLAA sites are in Flood Zone 1. T here are also a high num ber of sur face water management issues in Lis s and so it is r ecommended that Surface Water Management Plans (SWMPs) are undertaken for both Petersfield and Liss.

RECOMMENDATION 9: The WCS reco mmends that the SDNPA provides a li mit on run-off from new developments to reduce the risk of surface water flooding. As a minimum this should require no increase in discharge as a result of the development. It is recommended that steps are taken to ensure surface water runoff from brownfield sites is reduced by 30 percent (to take account of climate change) from existing rates. Surface water from greenfield sites should be dealt with by sustainable measures (not discharged to public sewer) unless it can be proven that this is not feasible. The evidence base should be used to s upport a reduced runoff rate in certain locations where appropriate. Alternatively, a tig hter requirement would be to restrict discharge at all sites to greenfield rates regardless of whether it is a brownfield or greenfield site.

RECOMMENDATION 10: The Floods and Water Management Act increases the emphasis placed on the use of SuDs within new developments. Any SuDs policy within the Local Plan will need to reflect this legislation. Flood risk can be managed by design and across the whole study area sustainable drainage should be a standard requirement, where these pose no risk to the chalk aquifers. Consideration should also be given to flood sensitive layout and site specific land use planning and flood evacuation routes (section 5.2.4).

Sustainable drainage techniques that m imic natural drainage, rather than using t raditional piped systems should be encouraged in all new developments. As such the Council should encourage construction of ponds or wetland areas. These will create green corridors in urban areas, providing benefits to flood alleviation, amenity, recreation and water quality. Land management techniques should be applied and enc ouraged where possible in rural areas to alleviate flooding. Examples include wetland creation and afforestation.

Table 5.2 sets out the floodrisk situation for each accepted SHLAA site. Section 5.2.6 presents a detailed list of flood risk recommendations. These should be consulted in addition to these summary recommendations.

RECOMMENDATION 11: More information on funding requirements and options should be collated as the development plans mature and more certainty regarding the location and numbers of dwellings per site are confirmed.

Appendix A
Data used in the study

Individual Local Authority planning data (available within the ANG):

South Downs National Park Authorit y (2014). *Access Network and Accessible Natural Greenspace Study (Main Report).* [Source: http://www.southdowns.gov.uk/planning/planning-policy/local-plan; Accessed: 27/03/2014].

Designated sites geographic information:

MAGIC: authoritative ge ographic information about the natural environment from across governm ent. Th e information covers rural, urban, coastal and marine environments across Great Britain.

[Source: http://www.magic.gov.uk/; Accessed: 27/03/2014].

Water company 2014 Water Resource Management Plans (WRMPs):

Southern Water (November 2013), *Revised Draft Water Resources Management Plan 2015-2040*. [Source: http://www.southernwater.co.uk/about-us/about-southern-water/our-publications/our-reports/WRMP/; Accessed: 27/03/2014].

South East Water (Novem ber 2013), *Revised Water Resources Management Plan*. [Source: http://www.southeastwater.co.uk/about-us/our-plans/water-resources-management-plan/wrmp-library; Accessed: 26/03/2014 – no longer available online].

South East Water (June 2014), *Final Water Resources Management Plan* [Source: http://www.southeastwater.co.uk/media/1114494/_contents_WRMP_0614a.pdf; Accessed: 05/06/2014].

Portsmouth Water (May 2013), *Revised Draft Water Resources Management Plan 2014*. [Source: http://www.portsmouthwater.co.uk/WorkArea/showcontent.aspx?id=10152; Accessed: 26/03/2014].

Catchment Abstraction Management Plans:

Adur and Ouse Abstraction Licensing Strategy (March 2013).

Arun and Western Streams Abstraction Licensing Strategy (March 2013).

Test and Itchen Abstraction Licensing Strategy (March 2013).

East Hampshire Abstraction Licensing Strategy (March 2013).

Water Framework Directive:

Environment Agency (2009). *River Basin Management Plan. South East River Basin District.* [Source:https://www.gov.uk/government/publications/south-east-river-basin-management-plan; Accessed: 26/03/2014].

Environment Agency GIS shapefiles.

Wastewater treatment capacity:

Southen Water technical assessment [Source: non published information, March/April 2014].

Thames Water technical assessment [Source: non published information: April – May 2014]

Chichester Water Quality Group (No vember 2012), *Water Quality and Strategic Growth for Chichester District background paper (November 2012) TW assessment*. [Source: http://www.chichester.gov.uk/index.cfm?articleid=22456; Accessed 02/06/2014].

Southern Water sewerage assessment [Source: Southern Water- DG5 database: March/April 2014].

Thames Water sewerage assessment [Source: Thames Water - DG5 database: April – May 2014].

Seven Catchment Flood Management Plans (CFMPs):

Environment Agency (2009) *River Adur Catchment Flood Management Plan. Summary Report.* Worthing.

Environment Agency (2009) *River Arun and Western Streams Catchment Flood Management Plan. Summary Report*. Worthing.

Environment Agency (2009) *Cuckmere and Sussex Havens Catchment Flood Management Plan. Summary Report*. Worthing.

Environment Agency (2009) *River Ouse Catchment Flood Management Plan. Summary Report*. Worthing.

Environment Agency (2009) *South East Hampshire Catchment Flood Management Plan. Summary Report*. Worthing.

Environment Agency (2009) *Test and Itchen Catchment Flood Management Plan. Summary Report*. Worthing.

Environment Agency (2009) *Thames Catchment Flood Management Plan. Summary Report*. Reading.

Ten District level Strategic Flood Risk Assessments (SFRAs):

Capita Symonds (2008) *Strategic Flood Risk Assessment. Arun District. Volume II Technical Report.*

Capita Symonds (2008) *Strategic Flood Risk Assessment of Chichester District Council. Volume I User Guide. Volume II Technical Report. Volume III Management Guide. Volume IV Assessment of Sites of Interest.*

Faber Maunsell (2009). *Lewes District Strategic Flood RiskAssessment Levels 1 and 2.*

Halcrow (2007) *Winchester City Council. Strategic Flood Risk Assessment for Local Development Framework.*

Halcrow (2008) *East Hampshire District Council. Strategic Flood Risk Assessment for Local Development Framework. Final.*

JBA Consulting (2012) *Adur District and Worthing Borough Councils' SFRA.*

JBA Consulting (2012) *Brighton and Hove Council. Strategic Flood Risk Assessment. Final.*

Mid Sussex District Council (2008). *Strategic Flood Risk Assessment.*

Scott Wilson (2007). *Horsham District Council. Strategic Flood Risk Assessment. Final Report.*

Scott Wilson (2008). *Eastbourne Borough Council and Wealden District Council. SFRA Final Level 1: Inception Report and Scope of Works.*

Scott Wilson (2009). *Eastbourne Borough Council and Wealden District Council. Final Level 2 Report.*

Two Shoreline Management Plans (SMPs):

South Downs Coastal Group (2006) *Beachy Head to Selsey Bill Shoreline Management Plan Final Document.*

South Downs Coastal Group (2006) *South Foreland to Beachy Head Shoreline Management Plan.*

Four Preliminary Flood Risk Assessments (PFRAs):

Halcrow (2011) *East Sussex Preliminary Flood Risk Assessment.*
Hampshire County Council (2011) *Preliminary Flood Risk Assessment 2011-2017.*
Peter Brett Associates (2011) *Brighton and Hove City. Preliminary Flood Risk Assessment. Preliminary Assessment Report.*
West Sussex County Council (2011) *West Sussex Preliminary Flood Risk Assessment.*

Surface Water Management Plans (SWMPs):

Peter Brett Associates (2014) *Brighton and Hove City Council. Surface Water Management Plan.*

Integrated Urban Drainage Pilot Studies:

Defra (2008) *Lewes Integrated Urban Drainage Pilot Study. Final Report – Volume 2. Project Code TRE 344.*

Tidal Strategies:

Environment Agency (2012) *Lower Tidal River Arun. Draft flood risk management strategy. Consultation on draft recommendations for managing the risk of flooding from the tidal River Arun.*

Appendix B
Water resource supply-demand balance data

Table B.1 Supply Demand Balance – Baseline and Final Planning, for Water Resource Zones

				2015/16	2019/20	2024/25	2029/30	2034/35	2039/40
Portsmouth Water	Company wide	DYA	Baseline	23.70	14.19	10.49	10.38	9.99	9.21
		PW	Baseline	44.99	44.02	43.05	40.57	38.57	25.78
Southeast Water	WRZ2	DYA	Baseline	-5.92	-9.89	-12.51	-15.82	-19.10	-21.64
			Final	0.77	4.53	0.76	19.82	13.06	18.48
		DY CP	Baseline	3.12	-3.35	-7.53	-12.11	-16.82	-20.91
			Final	4.25	3.95	0.39	5.69	0.89	3.96
	WRZ3	DYA	Baseline	4.43	2.60	1.36	-1.26	-3.58	-5.93
			Final	0.10	0.10	0.10	0.10	0.10	0.10
		DY CP	Baseline	-1.13	-4.63	-7.09	-10.92	-14.94	-18.05
			Final	0.10	0.10	0.10	0.10	0.10	0.10
	WRZ4	DYA	Baseline	21.64	13.75	12.44	8.56	3.93	-0.70
			Final	22.57	15.31	14.14	20.25	16.36	11.75
		DYCP	Baseline	-8.23	-17.22	-22.56	-31.10	-40.12	-50.19
			Final	2.51	14.72	9.53	11.00	2.70	2.10
	WRZ5	DYA	Baseline	14.05	13.83	13.55	12.68	12.07	11.00
		DY CP	Baseline	14.21	14.12	13.87	13.00	12.54	21.48
Southern Water	Hants South	DY MDO	Baseline	+80	-10	-45	-50	-55	-60
			Final	+75	+5	+10	+30	+25	+20
		DY CP	Baseline	+50	-25	-75	-80	-85	-90
			Final	+35	+1	+2	+20	+10	+0.5
	Sussex North	DY MDO	Baseline	-5	-13	-23	-25	-28	-33
			Final	0	0	+0.5	+9	+5	+0.5
		DY CPA	Baseline	+5	0	-15	-19	-22	-25
			Final	+5	+3	0	+8	+2	+0.5
	Sussex Worthing	DY MDO	Baseline	+5.5	-7	-11	-12	-14	-16
			Final	0	+2	+0.5	0	0	0

				2015/16	2019/20	2024/25	2029/30	2034/35	2039/40
		DY CP	Baseline	+4	-13	-18	-19	-20	-22
			Final	+5	+5	+2	0	0	0
	Sussex Brighton	DY MDO	Baseline	+6	-14	-29	-30	-34	-37
			Final	+11	+10	+11	+9	+12	+19
		DY CPA	Baseline	0	-18	-38	-40	-45	-50
			Final	+11	+14	+15	+15	+17	+23

DYA Dry Year Average; PW Peak Week; DY CP Dry Year Critical Period;

DY MDO Dry Year Mean Deployable Output; DY CPA Dry Year Critical Period Average

NB the Southern Water Baseline does not include inter zonal transfers of water

Data sources: Southeast Water: Final Draft WRMP Tables published 18/11/13, accessed online.

Southern Water: p269 onwards of Final WRMP published 18/11/14; accessed online.

Portsmouth Water: Final Draft WRMP published 01/11/13; accessed online.

Dry year annual average (DYAA) supply-demand balance forecasts

In each of the following figures (taken from the Water Resource Management Plans) the blue line is the demand forecast and the red line is the supply forecast.

Figure B.1 Portsmouth Water

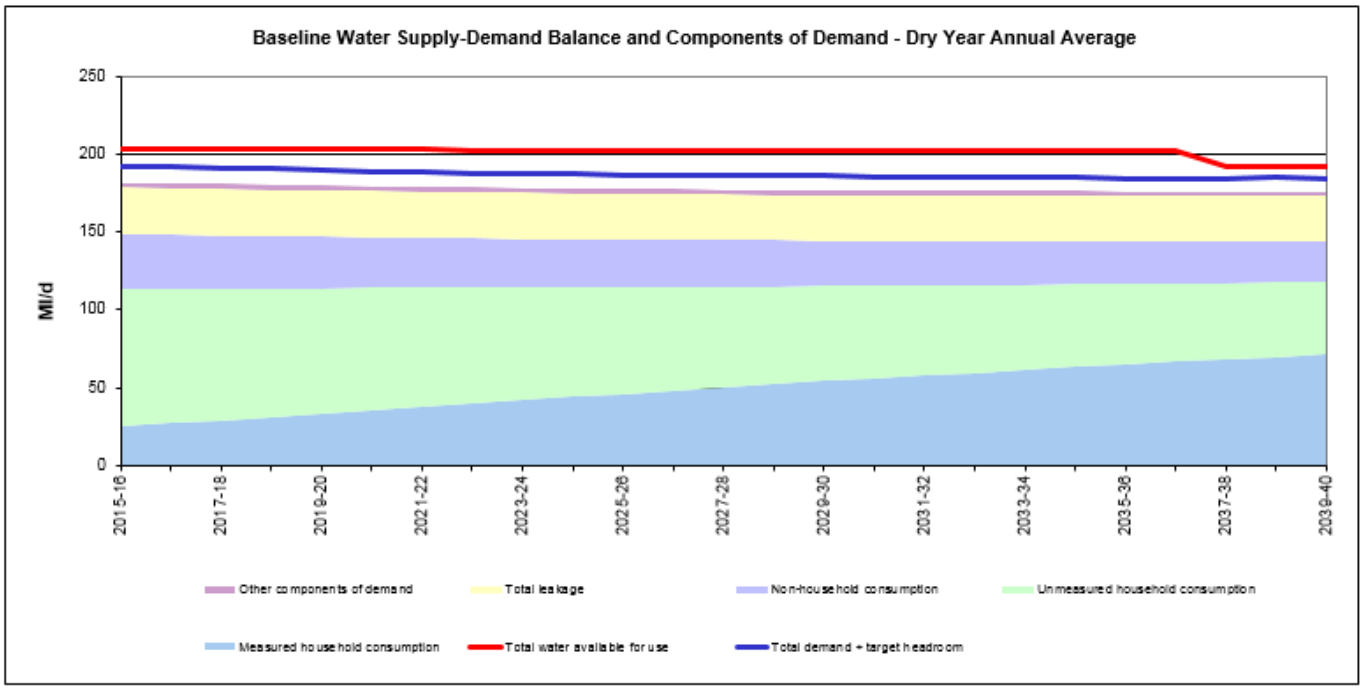


Figure B.2 South East Water (RZ2)

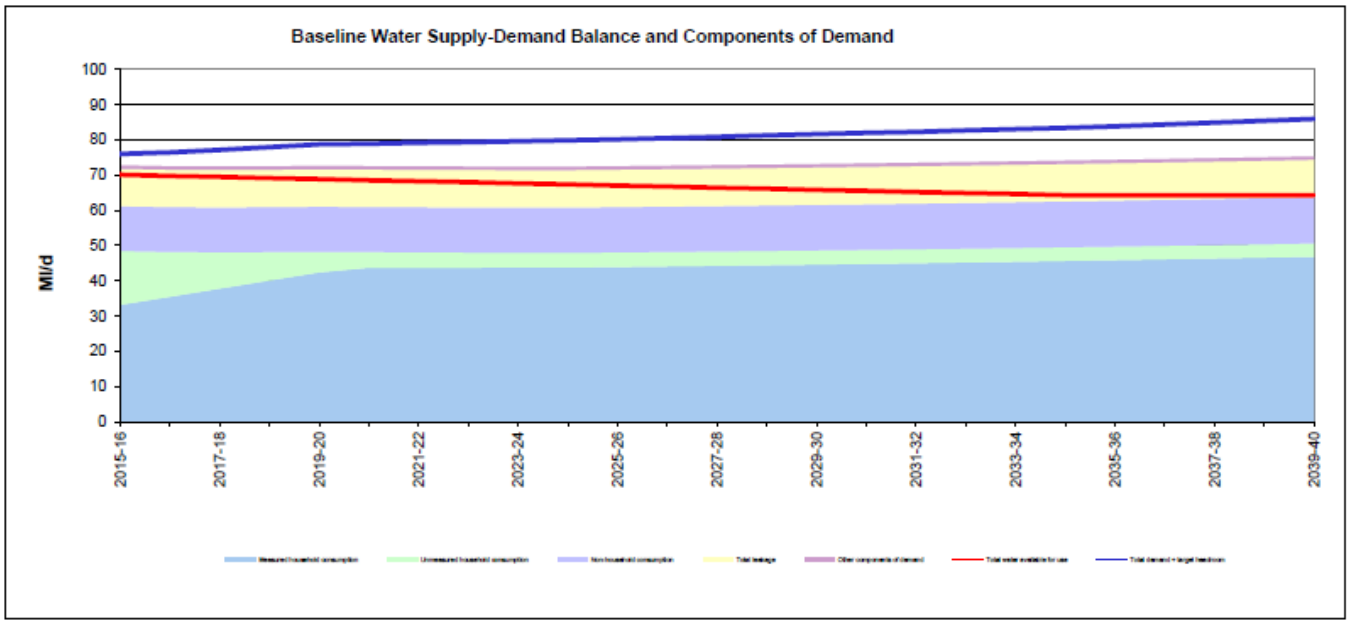


Figure B.3 South East Water (RZ3)

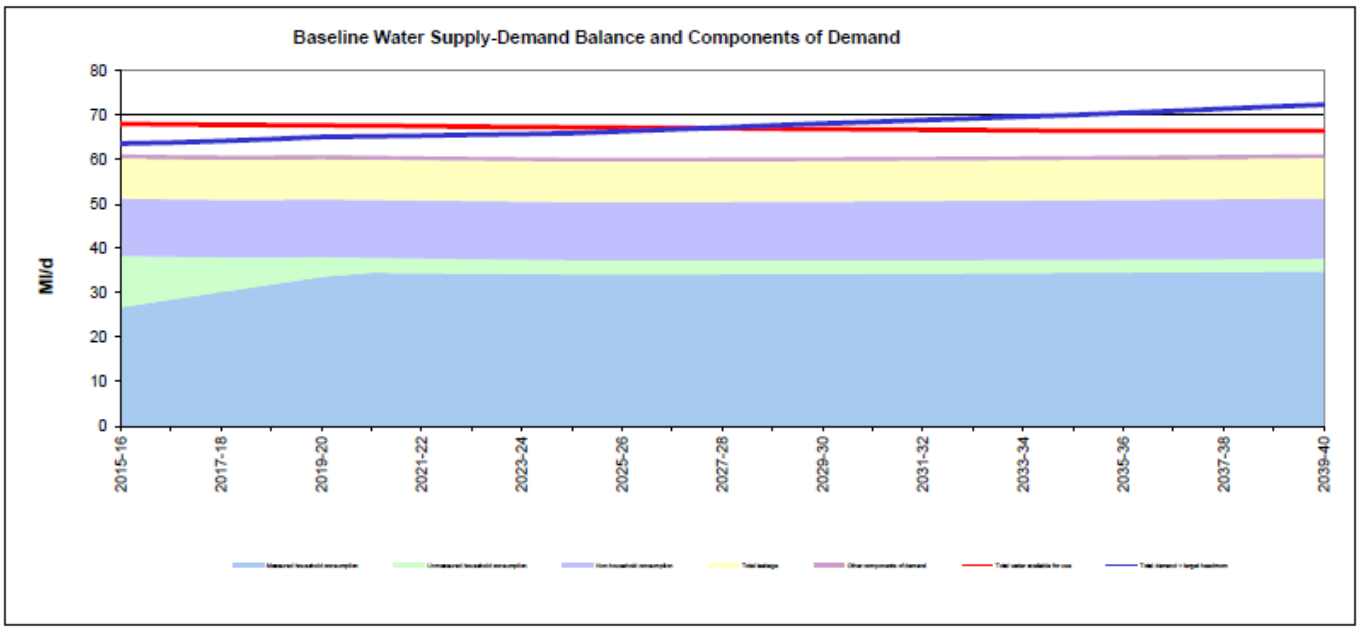


Figure B.4 South East Water (RZ4)

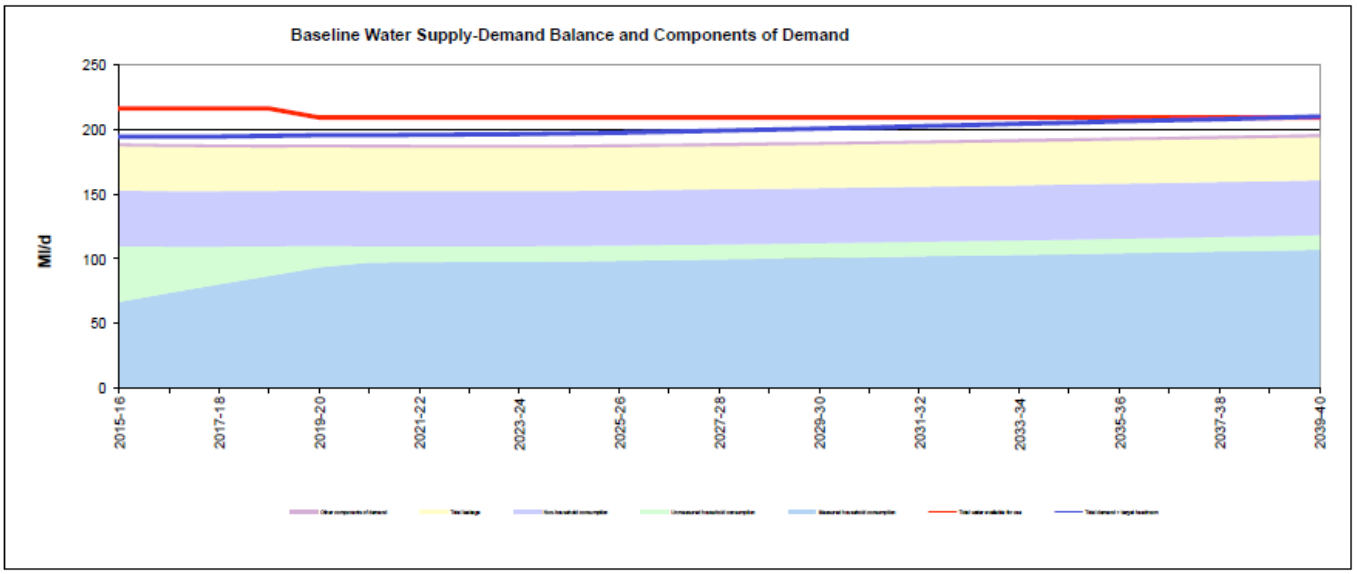


Figure B.5 South East Water (RZ5)

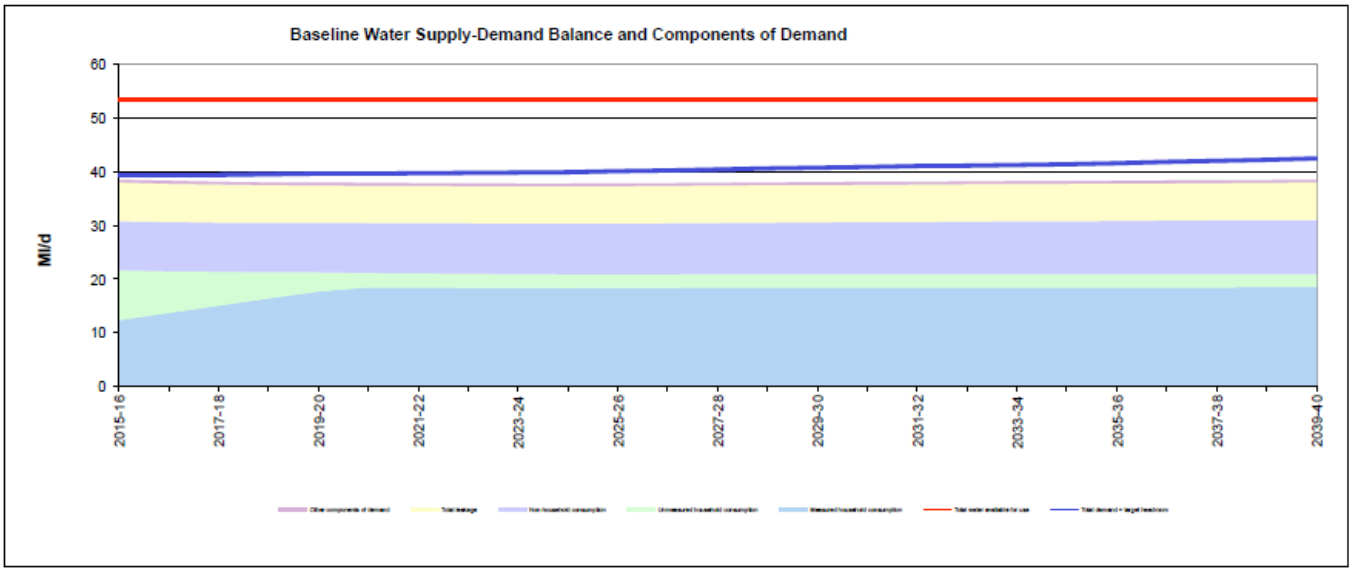


Figure B.6 Southern Water (Hampshire South)

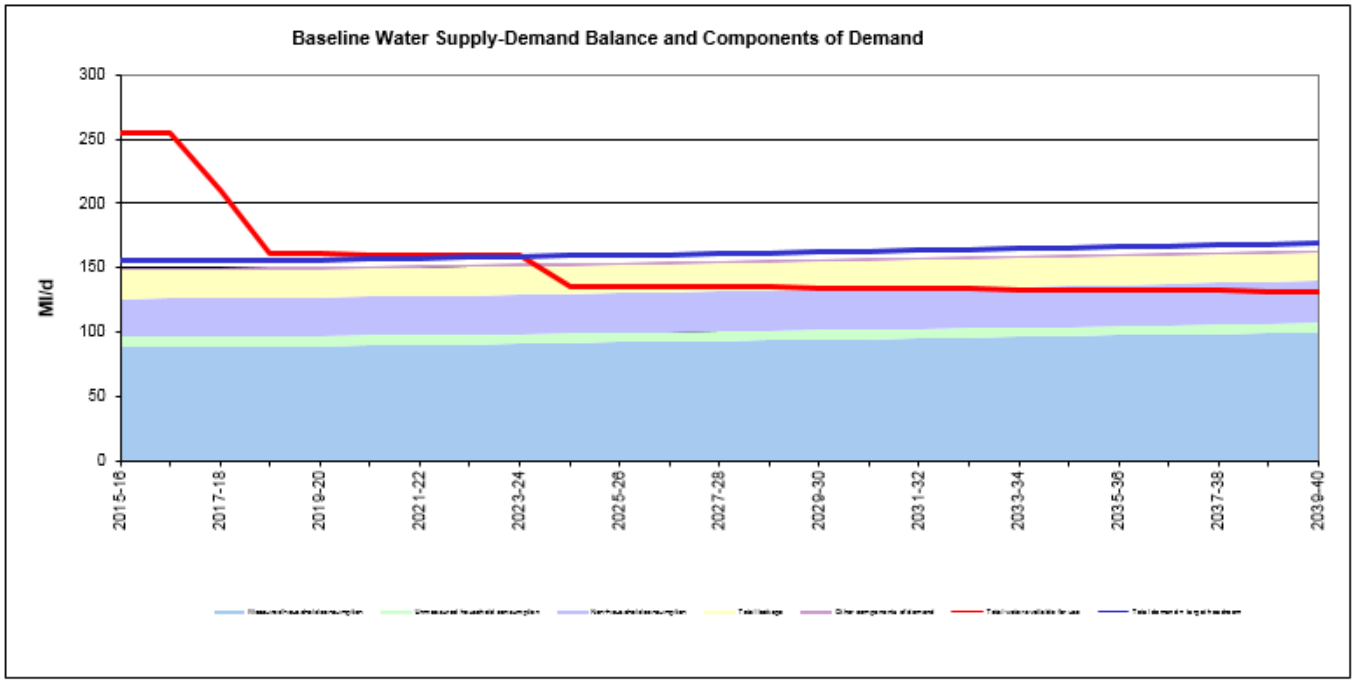


Figure B.7 Southern Water (Sussex North)

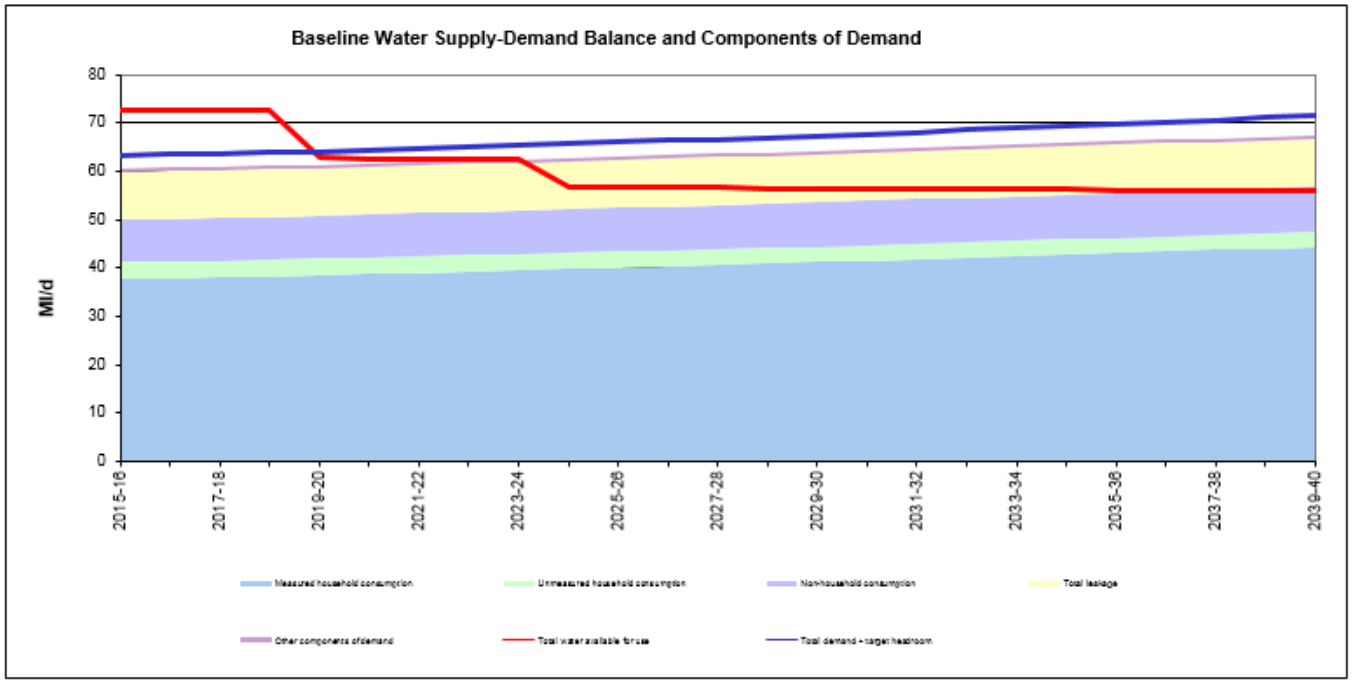


Figure B.8 Southern Water (Sussex Worthing)

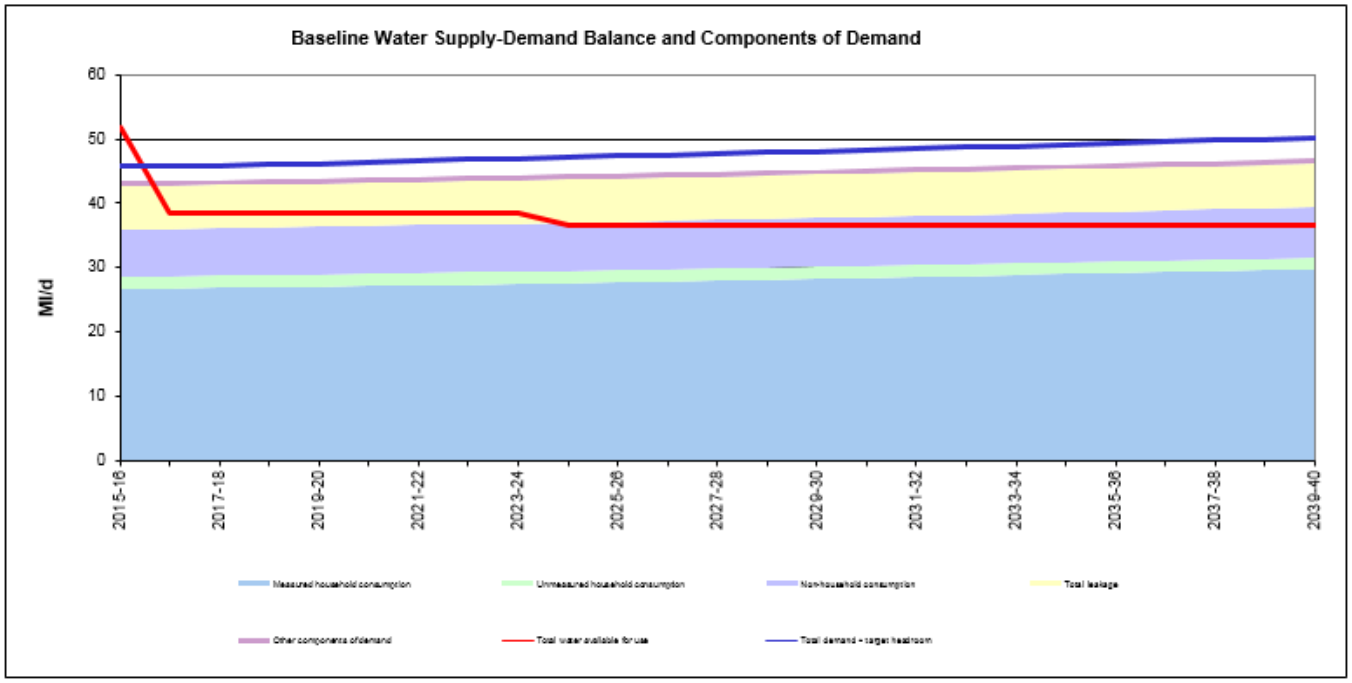


Figure B.9 Southern Water (Sussex Brighton)