CPRE Sussex Response to Amendments to the Proposed Submission Adur Local Plan (2016)

1 message

Lesley Wilson [redacted] 11 May 2016 at 12:20
To: adurplanningpolicy@adur-worthing.gov.uk

For the attention of the Planning Policy Team, Adur & Worthing Councils

Dear Sir/Madam

Please find attached the CPRE Sussex response to the Amendments to the Proposed Submission Adur Local Plan (2016) together with supporting documents:

- Stephen Buss further comment on groundwater flooding within the Adur Local Plan area, May 2016
- Waterco New Monks Farm, Adur strategic document review, May 2016
- Lancing Surface Water Management Plan, Non Technical Summary

We look forward to receiving your confirmation of receipt of this submission.

Yours faithfully

Lesley Wilson (Branch Administrator) on behalf of David Johnson, Chair

CPRE Sussex

CPRE Sussex Branch CIO, Brownings Farm, Blackboys, East Sussex TN22 5HG

[redacted] www.cpresussex.org.uk Registered Charity Number 1156568

We exist to promote the beauty, tranquillity and diversity of rural England by encouraging the sustainable use of land and other natural resources in town and country.

4 attachments

CPRE Sx response2 Adur LP May 2016.pdf
427K

Stephen Buss Final Report NMF May 2016.pdf
1402K

WaterCoreportNMFallocationMay2016.pdf
558K

Lancing_swmp_non_technical_summary.pdf
947K

Amendments to the Proposed Submission Adur Local Plan (2016)

Representation Form

Return Address:adurplanningpolicy@adur-worthing.gov.uk

Or:

Planning Policy Team, Adur and Worthing Councils, Town Hall, Chapel Road, Worthing, BN11 1BR

Or hand in at:

- **Shoreham Centre, 2 Pond Road, Shoreham-by-Sea, BN43 5WU or**
- **Portland House, 44 Richmond Road, Worthing, BN11 1HS**

Please return to Adur District Council by midnight on 11th May 2016
Late representations will not be considered.

Please note that at this stage, representations are only being sought on whether the amendments to the Plan are sound and/or legally compliant.

Use of your information: Respondent details and representations will be forwarded to the Secretary of State for consideration when the Adur Local Plan is submitted for examination. All documents will be held by Adur District Council and representations will be published including on the internet e.g. www.adur-worthing.gov.uk. Personal contact details (address, email and phone number) will be removed from published copies of representations. Your information will be handled in accordance with Data Protection Act 1998.

Contact details will be added to the Adur Planning Policy consultees database to keep you informed on the progress of the Adur Local Plan and other related documents.

☐ Please tick if you do **not** want to be informed.

This form has two parts:

i. Part A - Respondent Details. You only need to fill this in once.

ii. Part B - Your representation(s). Please fill in a separate sheet for each representation you make.

It is recommended that you read the Guidance Notes provided for an explanation of terms used in this form.

Part A – Personal Information

You only need to complete this section once

Personal Details

First name	David
Last name	Johnson
Organisation (where applicable)	CPRE Sussex Countryside Trust
Address line 1	Brownings Farm
Address line 2	Blackboys
Address line 3	Uckfield
Post Code	TN22 5HG
Telephone	[redacted]
Email address	[redacted]

Agent's Details (if applicable)

First name	
Last name	
Organisation	
Job Title	
Address line 1	
Address line 2	
Address line 3	
Post Code	
Telephone	
Email address	

Part B – Representation

Please use separate sheets for each representation

1. Which Amendment(s) to the Adur Local Plan does this representation relate to?

Amendments relating to:

Policy No.	5	Paragraph No.	
Map		Other section (please specify)	

2. Do you consider the Amendment(s) to be: (tick as appropriate)

2.1	Legally Compliant	Yes	☒	No	☐
2.2	Sound	Yes	☐	No	☒

Please read the Guidance Note for guidance on legal compliance and soundness.

If you have ticked no to 2.1, please continue to Q4.
If you have ticked no to 2.2, please continue to Q3.
If you have ticked yes to 2.1 and 2.2 please go to Q7.

3. Do you consider the Amendment(s) to the Adur Local Plan to be unsound because it is not: (tick as appropriate)

3.1	Positively Prepared	☐
3.2	Justified	☐
3.3	Effective	☒
3.4	Consistent with National Policy	☒

4. If you consider the Amendment(s) to the Adur Local Plan to be unsound or not legally compliant, please explain why in the box below:

CPRE Sussex works to promote the beauty, tranquillity and diversity of the Sussex countryside by encouraging the sustainable use of land and other natural resources in town and country. We encourage appropriate and sustainable land use, farming, woodland and biodiversity policies and practice to improve the well-being of rural communities. It is our position that local planning authorities should seek to ensure that the negative impacts of development on the countryside, both direct and indirect, are kept to a minimum and that development is sustainable in accordance with national planning policy.

We would like to draw your attention to (but will not reiterate) our comments as part of the 2014 Local Plan consultation in relation to Policies 2, 3, 4, 5, 6 and 7 as these have not been addressed through recent amendments. We believe that the current plan is not sound as further work needs to be done in relation to the exception test for flood risk to fully comply with the NPPF para 102. More work also needs to be done to establish how the investment in infrastructure needed to manage and mitigate flood risk at New Monks Farm will affect deliverability.

Policy 5, in relation to New Monks Farm, now states that 'Developers will need to work with Adur District Council, West Sussex County Council and the Environment Agency to ensure that tidal and fluvial flooding as well as surface water and groundwater flooding are adequately mitigated without worsening flood risk elsewhere. A Flood Risk Assessment (FRA) will be required at the planning application stage. The FRA must take account of and seek to facilitate relevant recommendations of the Lancing Surface Water Management Plan.'

Whilst CPRE Sussex welcomes the acknowledgement of the Lancing Surface Water Management Plan, the amendments to the Policy do not fully comply with National Policy and guidance.

Currently areas considered for domestic housing, such as New Monks Farm and West Sompting, are situated on what was part of the extensive and historic Adur River delta. New Monks Farm is still part of the Adur flood plain. Both areas are vulnerable to ground water and surface water flooding. In 2015, CPRE Sussex commissioned its own independent Flood Risk Assessment of the three proposed key strategic sites at New Monks Farm, West Sompting and Shoreham Airport. A copy of this Assessment is submitted with this representation. In May 2015, CPRE Sussex and Adur Flood Watch Group commissioned WaterCo to carry out a document review to establish whether the issues raised in our previous submission have been addressed by subsequent analysis and amendments to the Local Plan. A copy of this review is submitted with this representation. Also submitted is a 'further comment on groundwater flooding within the Adur Local Plan area' by Dr. Stephen Buss (2016) – also commissioned by Adur Floodwatch and CPRE Sussex.

The Sequential and Exception test for the Proposed Adur Local Plan (2016) document accurately describes the constraints facing the District in finding suitable new sites for housing:

'This objectively assessed housing need figure is not considered achievable due to a number of constraints within the district including flood risk and landscape constraints. As a result, there are not a large variety of sites to choose from in Adur – every site that is potentially deliverable and would not have unacceptable environmental, economic or social impacts is being put

forward in the Proposed Submission Adur Local Plan in order to try and meet objectively assessed needs as far as is possible.'

The aim of the Sequential Test is to steer new development into areas with the lowest probability of flooding i.e. areas outside of the 0.1% annual probability. The site has been assessed as having passed the NPPF Sequential Test, on the basis that there are no alternative sites in the area at lower flood risk which could accommodate a development of this size.

Where the Sequential Test is passed, the Exception Test should be applied. As stated in Paragraph 102 of the NPPF, for the Exception Test to be passed:

- 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
- 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.

In order to comply with Paragraph 102 of NPPF (the Exception Test), which states that development must be safe for its lifetime without increasing flood risk elsewhere, the document recommends a number of mitigation measures. However the WaterCo (2016) report states that:

'there is currently lack of detail given in regards to maximum on-site water levels and flood depths / velocities for the design tidal flood event (0.5% annual probability plus 100 years climate change allowance tidal flood event – including defence failure) in order to assess the viability of the mitigation measures.'

It also states that:

'The SFRA Core Strategy Site Flood Risk Assessments and 'Sequential and Exception Test for the Proposed Submission Adur Local Plan (March 2016)' state that the development should be resilient to future climate change and that floor raising and / or localised land raising above the 1 in 200 (0.5%) annual probability flood level for the year 2115 will be required to ensure the development is safe for its lifetime. Given the difference in potential extreme tidal levels and site levels, there may be limited scope to raise floor levels and significant land raising will be required. Land raising across a large extent of the site would likely lead to displacement of flood storage and increase in flood risk elsewhere.'

The WaterCo report (2016) recommends that further work is carried out to assess and determine the impacts of the proposed development on flood risk elsewhere before allocating this site and that;

'At this stage a study into the impacts and viability of the required mitigation measures (raising the development platform) should be undertaken. The study should establish:

- Maximum water levels, flood depths, velocities and hazards for the 0.5% annual probability plus 100 years climate change allowance tidal flood event, including for a failure of flood defences;
- The risk from a number of combined flood drivers i.e. the risk from surface water flooding from local ditches (Lancing Brooks), when outfalls becomes tide locked, combined with groundwater flooding;

- Design levels i.e. required land heights to ensure development is above the 0.5% annual probability plus 100 years climate change allowance tidal flood event;
- Means of safe access / egress and flood risk along such routes;
- The hydrological impact of localised ground raising on the existing groundwater and surface water regime;
- The impact of localised ground raising on flood risk elsewhere including a strategy to compensate for any potential loss of flood storage.

The above works will also identify the land take required for flood compensatory storage and the remaining land available for development. '

In terms of drainage, the Water Co report states that:

'Given the size of the development and issues identified within the foul drainage network by the West Sussex County Council Lancing Surface Water Management Plan (CH2M Hill, September 2015), it would be prudent to undertake an assessment of the capacity of the local sewerage infrastructure to accommodate a major development prior to allocation in the Adur Local Plan. The study, undertaken by / in conjunction with Southern Water should establish:
- The capacity of the existing sewer network
- The capacity of the existing waste water treatment works
- The works required to the existing sewerage network to accommodate a major development at New Monks Farm including costs and timescale for implementation.'

This is supported by Dr. Stephen Buss in his 'further comment on groundwater flooding within the Adur Local Plan area' document (2016) which states that flood management measures 'must robustly demonstrate **that all contributions to flooding** have been considered'

The WaterCo report (2016) concludes that:

'The assessments, as presently offered, appear to be incomplete and inadequate and do not provide a sufficiently robust basis for supporting the site allocation within the Adur Local Plan.'

West Sussex County Council, as the lead drainage authority, commissioned an in depth study of the drainage of the Lancing Gap within which New Monks Farm is located. This was carried out by CH2MHill and published in October 2015, the non-technical report is submitted with this representation. The study covers the geological and drainage influences and structure of the Lancing area**.** It does not anticipate the impacts of additional development, although it does conclude that in extreme weather Lancing will always be vulnerable to groundwater flooding no matter what mitigation is undertaken. It states:-

"Policy, construction and maintenance mitigation measures to alleviate the impacts of flooding in Lancing have been considered. Even with all of these measures in place Lancing will still be at risk of flooding during more extreme weather events. This is because drainage systems (both natural and man-made) and any other flood risk infrastructure will become overwhelmed during extreme weather events. In addition, Lancing is highly vulnerable to groundwater flooding (or drainage is affected by groundwater levels), which is significantly more technically and economically challenging to manage."

(Continue on a separate sheet if necessary)

5. Please explain in the box below what change(s) you consider necessary to make the Amendment(s) to the Adur Local Plan legally compliant and sound having regard to the reason you identified above.

(You will need to say why this change will make it legally compliant or sound. It will be helpful if you are able to put forward your suggested or revised wording. Please be as precise as possible).

CPRE Sussex would like to see further work carried out before the allocation of this site to assess and determine the impacts of the proposed development on flood risk elsewhere. A study into the impacts and viability of the required mitigation measures (raising the development platform) should be undertaken. The study should establish:

- Maximum water levels, flood depths, velocities and hazards for the 0.5% annual probability plus 100 years climate change allowance tidal flood event, including for a failure of flood defences;
- The risk from a number of combined flood drivers i.e. the risk from surface water flooding from local ditches (Lancing Brooks), when outfalls becomes tide locked, combined with groundwater flooding;
- Design levels i.e. required land heights to ensure development is above the 0.5% annual probability plus 100 years climate change allowance tidal flood event;
- Means of safe access / egress and flood risk along such routes;
- The hydrological impact of localised ground raising on the existing groundwater and surface water regime;
- The impact of localised ground raising on flood risk elsewhere including a strategy to compensate for any potential loss of flood storage.

The above works will also identify the land take required for flood compensatory storage and the remaining land available for development.

We believe that an assessment of the capacity of the local sewerage infrastructure to accommodate a major development should also be made prior to allocation in the Adur Local Plan. The study, undertaken by / in conjunction with Southern Water should establish:

- The capacity of the existing sewer network
- The capacity of the existing waste water treatment works
- The works required to the existing sewerage network to accommodate a major development at New Monks Farm including costs and timescale for implementation.'

If these assessments cannot demonstrate that viable mitigation measures are possible (and flood risk elsewhere is not increased for its lifetime) and appropriate infrastructure can be put in place within the timeframes available the development of the site will not be acceptable. It should then be deleted from the Plan.

(Continue on separate sheet if necessary)

6. If your representation concerns soundness or legal compliance and is seeking a change, do you consider it necessary to attend and give evidence at the hearing part of the examination? (tick as appropriate)

No, I wish to communicate through written representations ☐

Yes, I wish to speak to the Inspector at the hearing sessions ☒

Please note: The Inspector will determine the most appropriate procedure to hear those who have indicated that they wish to participate at the hearing part of the examination.

7. If you wish to participate at the hearing part of the examination, please outline why you consider this to be necessary.

CPRE Sussex wishes to submit evidence to the Inspector of flood risk and sustainability in relation to this and previous submissions.

8. Please tick if you <u>do not</u> wish to be informed of the following:

When the Plan has been submitted for Examination ☐

When the recommendations from the Examination have been Published ☐

When the Local Plan has been adopted ☐

What happens next?

Representations made to the Council will be passed to the Inspector for consideration.

Once this has happened, the Inspector will commence the examination and give notice of the start of the hearing sessions.

Interested parties will be informed of the start date of the hearing sessions and the matters to be considered.

Thank you for your representation.

New Monks Farm, Adur

Strategic Document Review

May 2016

Waterco Ltd, Eden Court, Lon Parcwr Business Park, Ruthin, Denbighshire LL15 1NJ
Tel: 01824 702220 **Email:** enquiries@waterco.co.uk **Web:** www.waterco.co.uk

w10055-160510-Document Review

DOCUMENT VERIFICATION RECORD

CLIENT:	CPRE Sussex Countryside Trust & Adur Flood Watch Group
SCHEME:	New Monks Farm, Adur
INSTRUCTION:	The instruction to carry out this report was received from Kia Trainor of CPRE Sussex Countryside Trust

DOCUMENT REVIEW & APPROVAL

AUTHOR:	Aled Williams BSc (Hons)
CHECKER:	Pedr Jones BSc (Hons) MA
APPROVER:	Peter Jones BSc (Hons) CEng C.WEM FICE MCIWEM

ISSUE HISTORY

ISSUE DATE	COMMENTS
01/05/2016	First issue
09/05/2016	Second issue
10/05/2016	Third issue

Contents

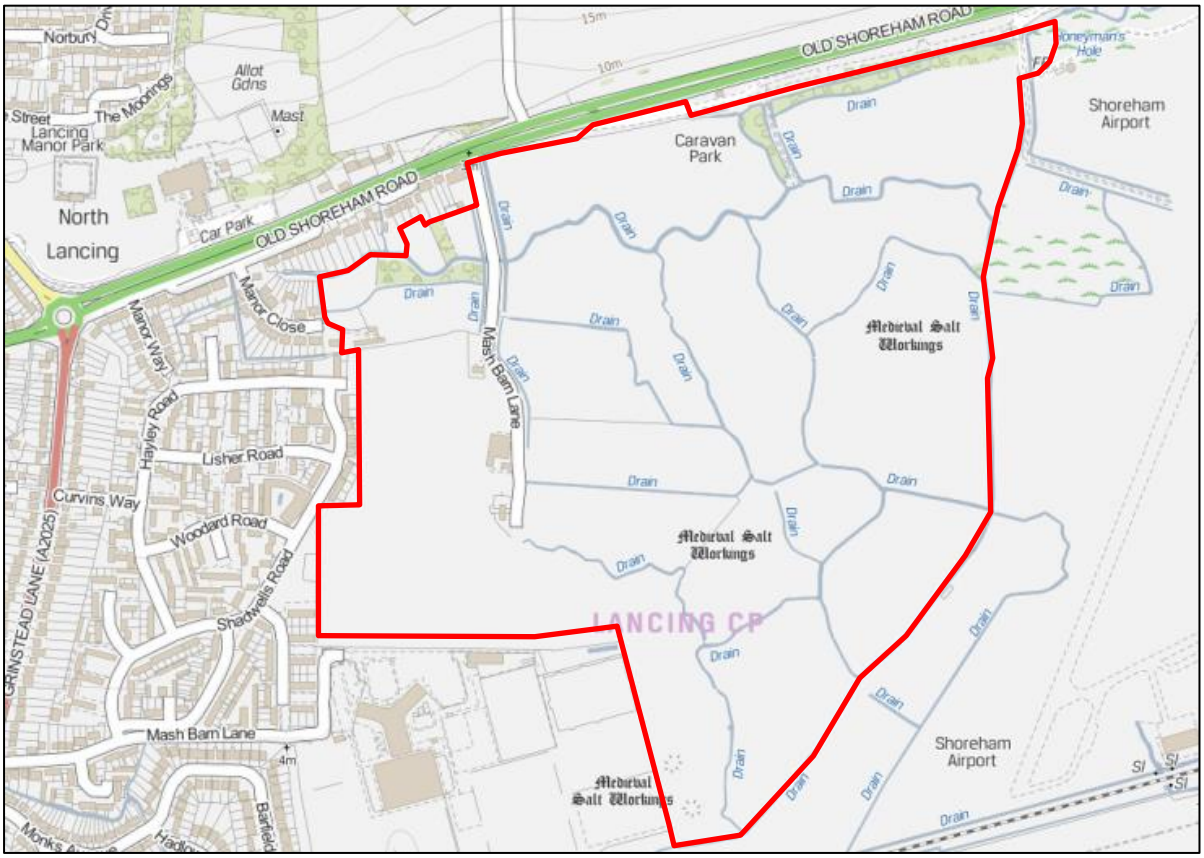
Figures

Introduction

Major site allocations have been proposed as part of the Adur Local Plan which was prepared for submission to the Secretary of State in 2015. The Adur Local Plan has been subject to a number of amendments and is now available for consultation.

Concerns in relation to flood risk and drainage have been raised in regards to a strategic site known as New Monks Farm. The site is located to the east of Lancing, Worthing at National Grid reference 519394E 105413N. A site location plan is provided as Figure 1 below:

Figure 1 – Location Plan – New Monks Farm



The allocation of the New Monks Farm site in the Adur Local Plan is supported by strategic documents including:

- Adur District and Worthing Borough Councils Strategic Flood Risk Assessment (SFRA) update (January 2012).
- SFRA Level 2 Core Strategy Site Flood Risk Assessment (January 2012) – New Monks Farm
- SFRA Level 2 Core Strategy Site Flood Risk Assessment (January 2012) – New Monks Farm Extension

Note – The Core Strategy Site Flood Risk Assessments combined cover the entirety of the New Monks Farm Site

- Sequential and Exception Test for the Proposed Submission Adur Local Plan (March 2016)

Waterco Consultants have been instructed by CPRE Sussex Countryside Trust & Adur Flood Watch Group to:

1) **Flood Risk:** Advise on the adequacy of the above assessments to; support the site allocation within the Adur Local Plan; demonstrate compliance with National Planning Policy Framework (NPPF) (paragraph 102) and the Planning Practice Guidance (PPG): Flood Risk and Coastal Change.

2) **Drainage:** Analyse the West Sussex County Council Lancing Surface Water Management Plan (CH2M Hill, September 2015) to assess whether it supports the findings of previous studies, namely the Ambiental Flood Risk Assessment Report (November 2014) which concludes that:

   'the sustainability of the infrastructure requirements of draining potentially hundreds of new homes, plus commercial space and associated roads and car parking into mains drainage may be questionable.'

3) Assess whether suitable analysis / works has been undertaken to conclude that: it is possible to mitigate the flood risk present to an acceptable level without compromising the viability of the scheme and without impacting on flood risk elsewhere.

This report is supported by a Groundwater Assessment undertaken by Stephen Buss Environmental Consulting Ltd (Document number: 2016-043-001-001 dated 28/04/2016).

Flood Risk

SFRA Core Strategy Site Flood Risk Assessments

The Core Strategy Site Flood Risk Assessments undertaken by JBA consulting as part of the Level 2 SFRA have been reviewed and a summary of findings is provided below:

Approximately 85% of the site is located within Flood Zone 3a on the Environment Agency Flood map for Planning (Rivers and Sea) – an area considered to be at high risk of tidal flooding with a 0.5% annual probability or greater of flooding in any given year.

Approximately 11% of the site is shown in Flood Zone 1, and therefore outside of the extreme 0.1% annual probability flood extent.

The existing tidal flood defences offer a standard of protection of less than 1 in 20 years. This means that the flood defences would be overtopped during tidal flood events with a 1 in 20 annual probability of occurrence or during more extreme events i.e. a 1 in 100 annual probability event. There are proposals to improve the tidal flood defences to offer a present day 1 in 200 years (0.5%) standard of protection. A residual risk of defence breach remains.

Significant tidal flood risk is estimated when accounting for climate change and wave overtopping. The entire site is shown at risk during the defended 0.5% annual probability event when applying climate change up to the years 2056, 2070 and 2115.

The SFRA states that the majority of the site is at low risk of surface water flooding, which is consistent with online Environment Agency surface water flood risk mapping. However localised areas of intermediate risk are shown adjacent to drainage channels (part of Lancing Brooks) and within the northern extent of the site.

The site is located within a 1km² grid cell that has a greater than 75% susceptibility to groundwater emergence.

Sequential and Exception Test for the Proposed Submission Adur Local Plan

The aim of the Sequential Test is to steer new development into areas with the lowest probability of flooding i.e. areas outside of the 0.1% annual probability.

Where the Sequential Test is passed, the Exception Test should be applied. As stated in Paragraph 102 of the NPPF, for the Exception Test to be passed:

- 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
- 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.

The Sequential and Exception Test for the Proposed Submission Adur Local Plan (March 2016) document has been reviewed and a summary of findings is provided below:

In relation to flood risk the document states that 'although this site is partly located within Flood Zone 3a, it has passed the sequential test, due to a lack of available alternative sites within the district to meet housing needs which are not at risk of flooding. However, a site specific sequential test needs to be undertaken to ensure the most vulnerable uses are directed to areas at least risk of flooding'.

The document also states that new development on site will have to be designed to minimise flood risk without increasing it elsewhere and that It should also be noted that this site suffers from significant surface water and groundwater flooding issues.

In order to comply with Paragraph 102 of NPPF (the Exception Test), which states that development must be safe for its lifetime without increasing flood risk elsewhere, the document recommends a number of mitigation measures including:

Tidal flooding mitigation

- completion of the Adur Tidal Walls scheme
- develop the site in a sequential approach with the most vulnerable uses located in areas of lowest risk
- raise floor levels above the 1 in 200 year floor level for 2115 and / or
- raise land above the 1 in 200 year floor level for 2115
- provide emergency plans
- provide flood resilient construction

Surface water flooding mitigation

- develop a surface water drainage strategy using SuDS principles
- maintain overland flow routes
- ensure runoff rates from the new development are below that prior to development
- incorporate the recommendations of the West Sussex County Council Lancing Surface Water Management Plan (CH2M Hill, September 2015)
- increase storage in the on-site ditch network
- safely manage rainfall events in excess of the 1 in 100 year plus climate change event.

Groundwater flooding mitigation

- provide engineering options to prevent interaction between the surface water or perched groundwater layer and the deeper groundwater associated with the chalk strata
- avoid infiltration
- provide additional capacity in the surface water system for additional flows from groundwater
- maintain existing capacity and conveyance between springs/groundwater and the ditch network.

Adequacy of Documents

The documents identify that the site is at risk of flooding and highlight the need to provide mitigation against the identified flood risk to ensure the development is safe for its lifetime. Currently 85% of the site is in a high risk tidal Flood Zone 3. The entire site is shown at risk of tidal flooding when accounting for climate change.

However, there is currently lack of detail given in regards to maximum on-site water levels and flood depths / velocities for the design tidal flood event (0.5% annual probability plus 100 years climate change allowance tidal flood event – including defence failure) in order to assess the viability of the mitigation measures.

The SFRA states that as part of the River Adur Tidal Walls modelling, the Tidal Walls will be constructed to a height of 4.84m AOD in the model for present day scenarios and an elevation of 5.53mAOD for scenarios beyond 50 years in the future. This indicates that extreme tide levels for the 0.5% annual probability tidal event when accounting for future climate change will be in the region of 5.5m AOD. A review of LiDAR levels indicates that a significant area of the site is situated below

3m AOD. Higher ground situated at approximately 4m AOD is located in the western extent. There is therefore potential for significant flood depths during the 0.5% annual probability plus 100 years climate change allowance tidal flood event.

The SFRA Core Strategy Site Flood Risk Assessments and 'Sequential and Exception Test for the Proposed Submission Adur Local Plan (March 2016)' state that the development should be resilient to future climate change and that floor raising and / or localised land raising above the 1 in 200 (0.5%) annual probability flood level for the year 2115 will be required to ensure the development is safe for its lifetime. Given the difference in potential extreme tidal levels and site levels, there may be limited scope to raise floor levels and significant land raising will be required. Land raising across a large extent of the site would likely lead to displacement of flood storage and increase in flood risk elsewhere.

Further Works in relation to flood risk

At this stage a study into the impacts and viability of the required mitigation measures (raising the development platform) should be undertaken.

The study should establish:

- Maximum water levels, flood depths, velocities and hazards for the 0.5% annual probability plus 100 years climate change allowance tidal flood event, including for a failure of flood defences;
- The risk from a number of combined flood drivers i.e. the risk from surface water flooding from local ditches (Lancing Brooks), when outfalls becomes tide locked, combined with groundwater flooding;
- Design levels i.e. required land heights to ensure development is above the 0.5% annual probability plus 100 years climate change allowance tidal flood event;
- Means of safe access / egress and flood risk along such routes;
- The hydrological impact of localised ground raising on the existing groundwater and surface water regime;
- The impact of localised ground raising on flood risk elsewhere including a strategy to compensate for any potential loss of flood storage.

The above works will also identify the land take required for flood compensatory storage and the remaining land available for development.

Drainage

CPRE Sussex Countryside Trust commissioned Ambiental Technical Solutions Limited to undertake a Flood Risk Assessment focusing on surface water and groundwater flooding. The report concluded that:

'the sustainability of the infrastructure requirements of draining potentially hundreds of new homes, plus commercial space and associated roads and car parking into mains drainage may be questionable.'

The West Sussex County Council Lancing Surface Water Management Plan (CH2M Hill, September 2015) (which covers the New Monks Farm development) has been undertaken to:

- confirm the catchment boundaries and comment on any differences with previous studies;
- gain a better understanding of the existing drainage network, connectivity, and ownership;
- understand the causes of flooding across Lancing from a range of sources including surface water, foul water, groundwater, watercourses, and tidal influence;
- understand the performance of the Lancing Brooks ditch network and identify how and when future maintenance of the ditches needs to be undertaken, and;
- identify any capital works required to mitigate flooding in Lancing

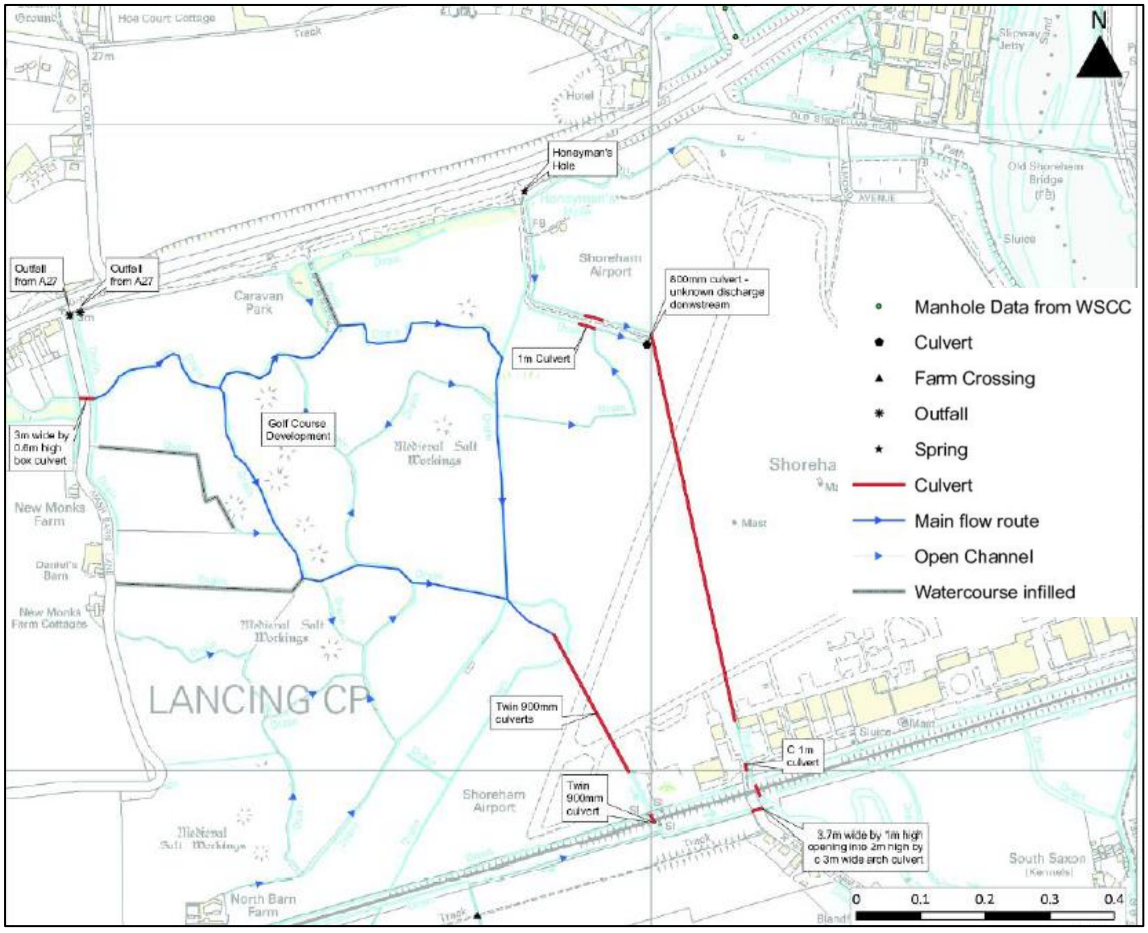
A review of the West Sussex County Council Lancing Surface Water Management Plan (CH2M Hill, September 2015) has been undertaken to assess whether it supports the findings of the Ambiental Flood Risk Assessment. A summary of findings is provided below:

The majority of the catchment drains towards a series of ditches (part of Lancing Brooks) within the New Monks Farm site. There are formal outfalls into the ditches from surrounding urban areas, however it is understood that the majority of properties in the surrounding area are drained by soakaways. The ditches discharge into a twin 900mm culvert which flows south beneath the airport and railway line. There is also an 800mm culvert which flows south beneath the airport and railway line. This culvert accommodates surface water runoff from local ditches as well as a proportion of spring water from Honeyman's Hole spring.

South of the railway, flows are directed eastward and into the Tidal River Adur. Tidal sluice gates are shown on the outfall to the Adur. Outflow from Lancing Brooks is dependent on tide levels. Figure 2

below, extracted from the West Sussex County Council Lancing Surface Water Management Plan (CH2M Hill, September 2015), shows the drainage regime for Lancing Brooks and New Monks Farm.

Figure 2 – Existing Drainage Regime



Localised issues with the foul drainage network have been identified, with groundwater ingress causing flooding.

Localised surface water flooding issues are also identified with the cause of flooding attributed to undersized drainage features (culverts and bridges causing throttle to flows), siltation of drainage ditches (Lancing Brooks), groundwater, and lack of maintenance (de-silting, clearing of drains and gullies and vegetation management).

A number of actions have been undertaken to alleviate flooding in the catchment. This includes:

- Clearance of Lancing Brooks (de-silting and vegetation clearance)
- Improvements (repairs, clearing and sealing) to the foul sewerage network
- Improvements to surface water drainage networks including; pipe clearing, de-silting of storage tanks, clearing of root infestation and repairs to the highway drainage system.

The West Sussex County Council Lancing Surface Water Management Plan Non Technical Summary (CH2M Hill) states that even with the mitigation measures in place, Lancing will still be at risk of flooding during more extreme weather events. This is because drainage systems (both natural and man-made) and any other flood risk infrastructure will become overwhelmed during extreme weather events.

Hydraulic modelling of Lancing Brooks has been undertaken to provide an overview of the conveyance of flows through the ditch system, and identify where there are pinch points in the system. The modelling found that:

- Silt build up within the ditch network greater than 150mm will cause significant impact on water levels.
- There is evidence of significant siltation or capacity constraints at several culverts, bridges and farm crossings
- Improvement works (maintenance and capital) to existing culverts significantly reduce the flood risk.

The report identifies a number of options to mitigate the flooding. Suggested mitigation measures include: upsizing of drainage features to provide additional attenuation and reduce any restriction to flows; and, frequent maintenance of drainage features (highway gullies & Lancing Brooks) including de-silting and vegetation clearance. Maintenance would be formalised through establishing a maintenance regime.

Adequacy of Documents

The West Sussex County Council Lancing Surface Water Management Plan (CH2M Hill, September 2015) sets out a strategy to mitigate an existing flooding issue. Mitigation measures to improve the drainage of Lancing Brooks are proposed. Regular maintenance of Lancing Brooks including de-silting and vegetation clearance is essential to minimise the flood risk.

The West Sussex County Council Lancing Surface Water Management Plan (CH2M Hill, September 2015) does not set out a strategy to accommodate future flows from major development. Surface water runoff from future development would need to be managed within the site through use of attenuation storage and flow control, ensuring no increase in off-site runoff rates. A detailed drainage strategy would be required in support of a planning application.

Further Works in relation to drainage

The following conclusion of the Ambiental Flood Risk Assessment is not intended to be addressed by the West Sussex County Council Lancing Surface Water Management Plan (CH2M Hill, September 2015).

'the sustainability of the infrastructure requirements of draining potentially hundreds of new homes, plus commercial space and associated roads and car parking into mains drainage may be questionable'

Given the size of the development and issues identified within the foul drainage network by the West Sussex County Council Lancing Surface Water Management Plan (CH2M Hill, September 2015), it would be prudent to undertake an assessment of the capacity of the local sewerage infrastructure to accommodate a major development prior to allocation in the Adur Local Plan. The study, undertaken by / in conjunction with Southern Water should establish:

- The capacity of the existing sewer network
- The capacity of the existing waste water treatment works
- The works required to the existing sewerage network to accommodate a major development at New Monks Farm including costs and timescale for implementation.

Conclusions

From the EA mapping the majority of the New Monks Farm site is identified as being at significant risk from tidal flooding. The site is also identified at risk from surface water and groundwater sources. Both the SFRA and the Surface Water Management Plan acknowledge this.

The site has been assessed as having passed the NPPF Sequential Test, on the basis that there are no alternative sites in the area at lower flood risk which could accommodate a development of this size.

Further work is required to assess and determine the impacts of the proposed development on flood risk elsewhere. The principal mitigation measure proposed in the core strategy is land raising; but this could amount to raising levels by some 2-3 metres over the majority of the site area. The proposition that this can be done without affecting flood risk elsewhere has not been substantiated and may prove to be both impractical and unviable.

Further work also appears to be required to establish whether the existing sewerage network can accommodate the development, or if infrastructure upgrades are required. Any potential infrastructure upgrades may be of significant scale to accommodate a development of 600 dwellings and may impact of development timescales.

The assessments, as presently offered, appear to be incomplete and inadequate and do not provide a sufficiently robust basis for supporting the site allocation within the Adur Local Plan.

Stephen Buss
Environmental Consulting Ltd

Further comment on groundwater flooding within the Adur Local Plan area

Version control log

Document number	Date	Issued by	Issued to	Comments
2016-043-001-002	10/5/2016	Steve Buss	CPRE	Final
2016-043-001-001	28/4/2016	Steve Buss	WaterCo	First draft

Client: WaterCo Consultants Ltd

Dated: May 2016

www.hydro-geology.co.uk

71 Canon Street, Shrewsbury SY2 5HH

Registered in England and Wales number 08595273

DISCLAIMER

This report has been prepared by Stephen Buss Environmental Consulting Ltd (SBEC) in its professional capacity as hydrogeologist, in a manner consistent with the level of care and skill ordinarily exercised by members of the geological and engineering professions practising at this time, within the agreed scope and terms of contract, and taking account of the manpower and resources devoted to it by agreement with its client.

The advice and opinions in this report should be read and relied on only in the context of the report as a whole. As with any environmental appraisal or investigation, the conclusions and observations are based on limited data. The risk of undiscovered environmental impairment of the property cannot be ruled out. SBEC cannot therefore warrant the actual conditions at the site and advice given is limited to those conditions for which information is held by SBEC at the time. The findings are based on the information made available to SBEC at the date of the report (and will have been assumed to be correct) and on current UK standards, codes, technology and practices as at that time.

This report is provided to the client addressed above. Should the client wish to release this report to any other third party for that party's reliance, SBEC accepts no responsibility to any third party to whom this report or any part thereof is made known. SBEC accepts no responsibility for any loss or damage incurred as a result, and the third party does not acquire any rights whatsoever, contractual or otherwise, against SBEC except as expressly agreed with SBEC in writing.

The findings do not purport to include any manner of legal advice or opinion. New information or changes in conditions and regulatory requirements may occur in future, which will change the conclusions presented here.

TABLE OF CONTENTS

Figures

1. Introduction

1.1 Project Background

Major site allocations have been proposed in the Adur Local Plan (consultation draft). There are local concerns that surface and groundwater flooding has not been adequately taken into account by the Council and that the key strategic sites at New Monks Farm, land west of Sompting, and Shoreham Airport are therefore not demonstrably deliverable.

Stephen Buss Environmental Consulting Ltd (SBEC) was previously instructed by Ambiental Technical Solutions Ltd, on behalf of the Campaign to Protect Rural England (CPRE) to review evidence made available in November 2014, to prepare an overview of the sensitivity of the location with respect to groundwater flooding, and to identify any omissions from the Adur Local Plan and its supporting documents. A review of the findings of that report is given in Section 1.2 below.

New supporting material has since been submitted to CPRE, in particular:

- Interpretative Hydrogeological Report on Groundwater Levels and Influencing Factors for New Monks Farm Developments Ltd[1] (Capita Symonds, April 2014), and,
- West Sussex County Council Lancing Surface Water Management Plan[2] (CH2M Hill, September 2015).

SBEC was therefore instructed in April 2016 by WaterCo Consultants Ltd, on behalf of CPRE again, to review the former document and make comment on any hydrogeological aspects raised in the latter.

This report has been prepared by Dr Stephen Buss MA MSc CGeol. Dr Buss is a UK-based independent hydrogeologist with more than 15 years' consulting experience in solving groundwater issues for the Environment Agency, water companies and other private sector organisations. Dr Buss's CV and publications list is available at www.hydro-geology.co.uk.

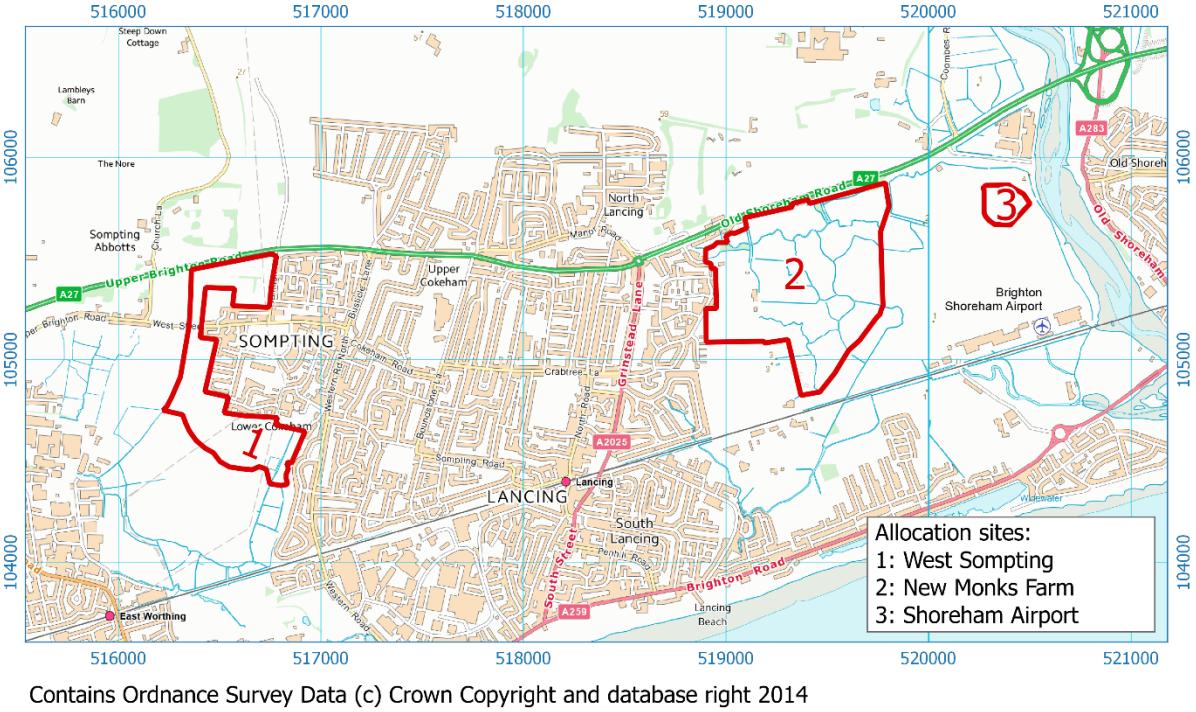
Disclaimer: Dr Buss has in the past worked with Trevor Muten, who was checker for Capita Symonds (2014) interpretative hydrogeological report for New Monks Farm; and with hydrogeology specialists at CH2MHill who will have had input to the Lancing SWMP (CH2MHill, 2015). Dr Buss is currently a technical advisor to CH2MHill on a groundwater model of the Oxford flood plain. No conflict of interest is perceived.

[1] http://www.adur-worthing.gov.uk/media/media,130203,en.pdf
[2] https://www.westsussex.gov.uk/media/6139/lancing_swmp_final_technical_report.pdf

1.2 Previous Findings

Context

The Adur Local Plan[3] identifies three greenfield sites for development: New Monks Farm, land west of Sompting, and Shoreham Airport (Figure 1.1).



Contains Ordnance Survey Data (c) Crown Copyright and database right 2014

Figure 1.1 Allocation areas

Historical groundwater flooding events are mapped in the Strategic Flood Risk Assessment (SFRA)[4]. A handful of events are mapped around the headwaters of the Teville Stream just outside of the West Sompting allocated area. However, there is more information on groundwater flooding in the New Monks Farm area, in the Sequential and Exception Test document[5], which states that, '…this site suffers from significant surface water and groundwater flooding issues. These issues have been investigated further by the developer and the draft interim conclusions indicate that these issues can be mitigated. These draft conclusions have also been agreed by West Sussex County Council as the Local Lead Flood Authority'. This investigation was not seen by SBEC at the time of preparation of the review report (in late 2014), but this has been reviewed for the present study (Section 2.1).

Physical setting

All three sites lie on the coastal plain south of the South Downs, either side of the town of Sompting. The plain is low lying and, other than a small area of the West Sompting site, the elevation of the sites is less than 10 m above Ordnance Datum (AOD). Local hydrology (Figure 1.2) is dominated by the tidal River Adur, to the east of the sites, and the proximity to the coast. Shoreham Airport is in the functional floodplain of the River Adur. New Monks Farm is also within the flood plain area of the River Adur but actually comprises the extensively-drained catchment of the Willow Brook which flows through South Lancing (depth of the drains is indicated well in the terrain map above). West Sompting is in the upper catchment of the Teville Stream, which separates East Worthing and Lancing.

[3] www.adur-worthing.gov.uk/adur-local-plan-2014/
[4] www.adur-worthing.gov.uk/media/media,87182,en.pdf
[5] www.adur-worthing.gov.uk/media/media,127799,en.pdf

Bedrock geology at all three sites comprises Chalk (Figure 1.2), which is a very permeable rock and forms the principal groundwater supply for Southern and South East England. West of Sompting the Chalk is overlain by Head, which is a superficial deposit comprising mixed sand, silt and clay that develops from sub-aerial weathering of the hills that for the South Downs. East of Lancing the Chalk is overlain by alluvium. This is, again, a mixed sand, silt and clay deposit, which forms by deposition from rivers. Extensive drainage in the Willow Brook catchment suggests that the alluvium has in places rather low permeability.

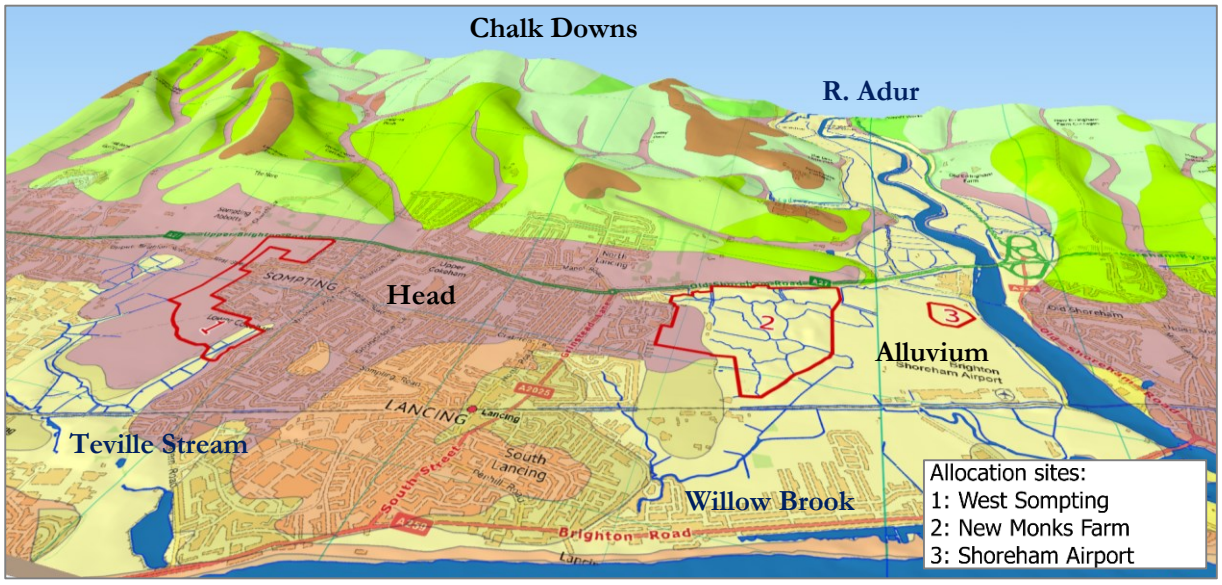


Figure 1.2 Geology and hydrology (2.5 x vertical exaggeration)

Hydrogeology

The conceptual model presented for the Lancing Surface Water Management Plan (CH2MHill, 2015) is a good cross-section of the site geology (Figure 1.3). This shows groundwater moving southwards from the topographic high of the South Downs, underneath the low permeability sediments of the coastal plain. Springs emerge at the position where the chalk outcrop dips under the superficial sediments (Honeymans Hole Spring here) and at any location where there is a permeable pathway out to the coast.

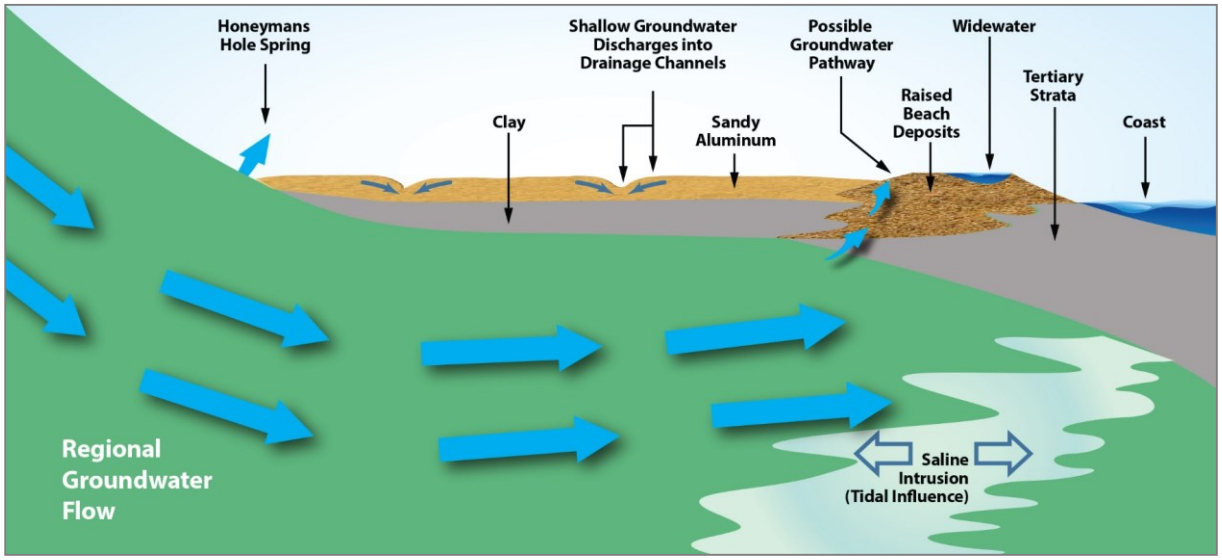


Figure 1.3 Schematic north-south cross-section of site geology

Conclusions

There is a spring line at the foot of the South Downs, where the Chalk aquifer dips below a cover of low permeability superficial deposits. There is firm evidence of groundwater emergence along this geological boundary (roughly along the route of the A27). Emergence of groundwater here already causes local flooding issues. Superficial deposits communicate tidal and river levels inland from the water bodies. In this environment, where river, coastal, surface water and groundwater flooding interact it is essential to develop a firm understanding of the inter-dependencies.

Up to November 2014 it appeared that modelling and strategic flood risk assessments take into account each flood mechanism as an isolated event. Convergence of several flood drivers (e.g. high groundwater levels plus high rainfall) may combine to cause unanticipated levels of flooding. Review of the developer's investigation on surface water and groundwater flooding at New Monks Farm site (which was not seen at that stage) was required to better understand the work that has already been done.

It was clear that most if not all of the allocated areas are going to be unsuitable for infiltration SUDS and all developments will need to use attenuation SUDS or be connected to mains drainage.

2. Review of New Supporting Material

2.1 Interpretative Hydrogeological Report… for New Monks Farm (Capita Symonds, 2014)

Ten pairs of shallow and deep boreholes were installed within the area of the New Monks Farm development. Shallow boreholes targeted groundwater in superficial deposits, and the deep boreholes targeted groundwater levels in the underlying chalk aquifer. Several stream stage monitoring points were also established within and around the development area. The monitoring period (February to March 2014) was relatively short but serendipitously that period followed extremely high, and long duration, rainfall; at that time groundwater flooding was experienced in North Lancing and across southern England.

It was found that groundwater flooding did not happen within the development area during early 2014 despite the extreme rainfall, and instances elsewhere on the South Coast. There was groundwater flooding and a risk of sewer flooding in North Lancing close to the A27. This excess water was pumped into the surface water drainage to discharge via the Lancing Brooks to the River Adur or the sea. (This was repeated in winter 2015/16 – Bill Freeman pers. comm.)

The key finding of the study was that the chalk and superficial aquifers do not exchange significant amounts of groundwater. This was based on groundwater level data only, not on an assessment of water fluxes in and out of the system (i.e. a water balance), which is important: strong control of superficial groundwater levels by the surface water drainage system may mask effects that arise from weaker control by chalk heads. Nevertheless, borehole logs consistently record a layer of low permeability deposits between the chalk and the near-surface superficial deposits, so the inference of limited groundwater exchange is likely to be sound.

There were two key recommendations from the study.

- Developers must preserve the surface water drainage capacity within the development site. The report cites tidal flows, perched groundwater storage, discharge from groundwater springs, and pumping from outside the catchment as additional sources of water to the drains.
- Developers must not breach the sealing layer of low permeability deposits that confine the chalk aquifer. This prevents artesian groundwater from the chalk rising into the drainage system during periods of high groundwater levels, and also prevents contamination of the drinking water resource during periods of low groundwater levels.

2.2 Lancing Surface Water Management Plan (CH2MHill, 2015)

The Lancing SWMP (CH2MHill, 2015) properly recognises the importance of groundwater to the hydrological system and goes into depth explaining the process of groundwater flooding and its incidence in the area. The study area of CH2MHill (2015) does not include the Shoreham airport or West Sompting allocation sites.

Section 2.3.3 of CH2MHill (2015) reviews the interpretative hydrogeological report for New Monks Farm (Capita Symonds, 2014). (And it includes a slightly more detailed summary than is provided above.) The findings of Capita Symonds (2014) are not contradicted by the findings of the CH2MHill (2015).

Section 5.2 of CH2MHill (2015) describes the processes of drainage via Lancing Brooks, which is the area to be partly occupied by any development at New Monks Farm. Section 6 describes a hydraulic modelling study of the Lancing Brooks. The purpose of the model was to understand conveyance, so flows were not based on detailed rainfall-runoff calculations undertaken for the study area, but were based on flow estimates for 1 in 10 and 1 in 100 year storms from a 1994 study by Monson Engineering[6] (which has not been reviewed for this study).

[6] Monson Engineering, 1994. Report on the Survey and Hydraulic Analysis of Lancing Drainage Ditches

One of the two key lessons from Capita Symonds (2014) was that flow into the Lancing Brooks arises from multiple sources as well as runoff: shallow groundwater, chalk groundwater, and pumping from outside the catchment. These are not likely to have been accounted for in the estimated flows from the Monson Engineering (1994) report (though tidal locking was considered) so the flows given for storms with specific return periods may be underestimated.

For instance if the design 1 in 100 year storm had occurred during February 2014, coincident with high chalk spring discharges into the Lancing Brooks catchment and pumping to reduce risk of sewer flooding in North Lancing, total flows in Lancing Brook would have been rather higher than anticipated from the rainfall alone. In effect (and using estimated return periods for illustration only) the 1 in 100 year storm may have given rise to, say, 1 in 200 year flows.

This does not invalidate the findings of the CH2MHill (2015) modelling, because the flow rates used were not critical to the aims of the study. However, it illustrates how the external water inputs identified by Capita Symonds (2014) can be overlooked in modelling studies.

As a result of the modelling a number of recommendations are made for improving the conveyance of water through the Lancing Brooks catchment.

3. Conclusions and Recommendations

3.1 Conclusions

Two documents have been reviewed that have been released since the compilation by SBEC (2014) of a review of the three proposed major site allocations in the Adur Local Plan.

The interpretative hydrogeological report for New Monks Farm (Capita Symonds, 2014) reports on a study from borehole data at the New Monks Farm site over a limited time during which there was, serendipitously, considerable rainfall. No groundwater flooding was observed at the site and there were no indications that it would be imminent. The hydrogeology of the site is well characterised except that a water balance is omitted; a water balance with the available data would be very difficult to quantify with certainty, so it is not an omission (though it would help if the limitations that prevent development of a water balance were presented).

The two key recommendations from the Capita Symonds (2014) study were sensible. Firstly, developers must preserve the surface water drainage capacity within the development site. The report cites tidal flows, perched groundwater storage, discharge from groundwater springs, and pumping from outside the catchment as additional sources of water to the drains. Secondly, developers must not breach the sealing layer of low permeability deposits that confine the chalk aquifer. This prevents artesian groundwater from the chalk rising into the drainage system during periods of high groundwater levels, and also prevents contamination of the drinking water resource during periods of low groundwater levels.

The Lancing Surface Water Management Plan (CH2MHill, 2015) goes into more depth on groundwater than is usual in a SWMP, which is appropriate given the importance of groundwater to flooding in the area. Findings of CH2MHill (2015) do not contradict the findings of the interpretative hydrogeological report for New Monks Farm (Capita Symonds, 2014). The conclusions of CH2MHill (2015) do not appear to bear influence on the specific proposals for development at New Monks Farm.

3.2 Recommendations

Recommendations from Capita Symonds (2014) are supported by the evidence reviewed in this report and the previous one by SBEC (2014). Flows in the Lancing Brooks are not just a result of rainfall-runoff or of groundwater alone. Therefore traditional rainfall-runoff modelling would tend to underestimate flows in the ditches for a given return period.

Any flood risk modelling submitted for the New Monks Farm development must take account of groundwater discharge and emergency pumping of water from outside the catchment, as well as rainfall-runoff, when estimating discharge capacities. This is a key part of ensuring that, post-development, the developers preserve the surface water drainage capacity within the development site. Discharge locations and rates for these external inputs to the drainage system should be proposed based on the findings of Capita Symonds (2014) and of CH2MHill (2015).

The second recommendation of Capita Symonds (2014) was that developers must not breach the sealing layer of low permeability deposits that confine the chalk aquifer. This is considered appropriate.

To clarify a recommendation made in the previous report written by SBEC (2014), it is clear that most if not all of the allocated areas are going to be unsuitable for infiltration SUDS and developments will need to be connected to attenuation SUDS or to mains drainage. The design discharge rate for attenuation SUDS must take into account the possible presence of other sources of water in the receiving watercourses.

To summarise, there appears to be no reason to prevent development at the New Monks Farm site on the basis of risk of groundwater flooding alone. Appropriate drainage works will be able to convey water away from the site. However, the applicants must robustly demonstrate that all contributions to flooding have been considered when devising flood management.

Lancing Surface Water Management Plan (SWMP)

Non Technical Summary

What is a SWMP?

Surface Water Management Plans, or SWMPs for short, look at flooding that occurs in response rainfall when:

- sewers and drains become inundated;
- waterlogged ground leads to runoff from land;
- small rivers and/or ditches overflow, and;
- water contained within rocks under the ground rises up above the surface (this is called groundwater flooding).

A SWMP sets out a long-term action plan for dealing with types of flooding.

The Lancing SWMP

The SWMP for the Lancing has been prepared by CH2M HILL on behalf of West Sussex County Council. Work began in July 2014 and the final report was issued in October 2015.

The study area is shown in Figure 1 below. The study area covers the entire catchment from the west which drains towards the Lancing Brooks. The most northerly location of the study area is the open space to the north of Firle Road (in North Lancing). To the east the River Adur forms a natural catchment boundary and the Lancing Brooks discharge into the Adur. To the south the sea forms the natural catchment boundary.

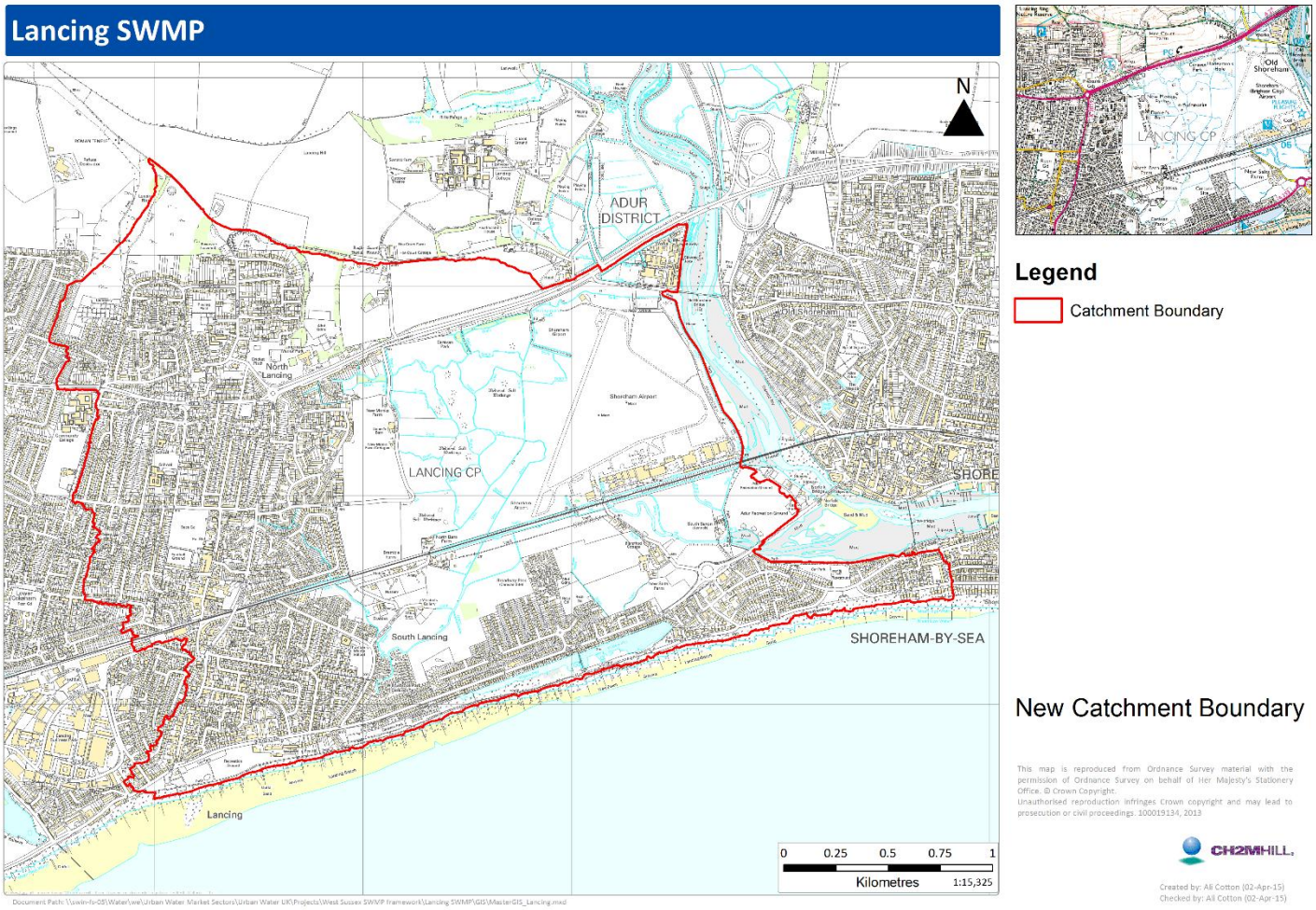


Figure 1 – Lancing SWMP Catchment Boundary

Lancing Surface Water Management Plan (SWMP)

During the development of the SMWP there has been engagement with key stakeholders, including West Sussex County Council (WSCC), Adur and Worthing Councils, the Environment Agency, Southern Water, local flood action groups, and Shoreham Airport.

Objectives

The objectives of the Lancing SWMP were to:

- confirm the catchment boundaries and comment on any differences with previous studies;
- gain a better understanding of the existing drainage network, connectivity, and ownership;
- understand the causes of flooding across Lancing from a range of sources including surface water, foul water, groundwater, watercourses, and tidal influence;
- understand the performance of the Lancing Brooks ditch network and identify how and when future maintenance of the ditches needs to be undertaken, and;
- identify any construction works required to mitigate flooding in Lancing.

Methodology

The methodology for the project broadly follows the SWMP Technical Guidance published by Defra in 2010. The key project stages were as follows:

1. Data collection and review
   - Define the study area
   - Consider historic flooding
2. Consider inflows and outflows from the system
   - Identify 'pinch points' within the catchment
   - Engage with stakeholders
3. Site vists and surveys
4. Consider options to alleviate flooding
   - Develop Water Level Management Plan

Data

A wide range of data were collated and analysed to help understand the local flooding issues. This included data from previous studies in Lancing (e.g. Royal Haskoning Watercourse Study, Monson Engineering Study), historic flooding data, and information on historic rainfall, topography and drainage. All this information was compiled and mapped using computer based Geographic Information Systems.

Flooding in West Beach Estate

Recent flooding issues

There is good anecdotal evidence of flooding within Lancing from the wet winters of 2012/13 and 2013/14, and ongoing reporting from local residents throughout 2014 and 2015. Flooding in Lancing has been a long-standing problem, but the best anecdotal evidence of flooding is from the last two to three years. Given that 2013/14 was the wettest winter on record it is reasonable to assume that the available anecdotal evidence from the past two to three years provides a good basis to assess the flooding impacts. The table below provides an overview of the key locations affected by flooding in Lancing.

Location	No. properties flooded internally	Other impacts
Grinstead Lane, Manor Way, Manor Close	Garages flooded on Manor Way	Extensive flooding on Grinstead Lane (impassable), restricted toilet use, garden flooding, and overpumping of foul network into ditch network
Old Shoreham Road (cul-de-sacs south of A27	None	Flooding on Old Shoreham Road Garden flooding
Barfield Park and Monks Avenue	1 home affected on Barfield Park 1 property flooded near Monks Avenue/Hadlow Way	Garden flooding in other locations
The Paddocks	Garages flooded	Highway flooding
West Beach Estate	None	Flooding across most of The Broadway, and parts of Westway and Prince Avenue

Location	No. properties flooded internally	Other impacts
A27	None	Northern carriageway of A27 flooded
Shoreham Airport	None	Airport flooded, although main runway was still operational

Causes of flooding

The causes of flooding have been identified through site visits, stakeholder engagement, cross-section and limited manhole surveys, and hydraulic modelling. Lancing is vulnerable to flooding from multiple causes including surface water, groundwater, sewer flooding, and due to capacity constraints in the Lancing Brooks. The table below summarises the key causes of flooding to the locations which are most vulnerable to flooding in Lancing

Location	Causes of flooding
Grinstead Lane, Manor Way, Manor Close & Old Shoreham Road	• High sensitivity to groundwater emergence • Influence of high groundwater on the performance of foul and surface water network • Culverts on Manor Close and Mash Barn Lane • Maintenance of the Lancing Brooks • Under-sized drainage around Manor Way which can exacerbate flooding along Grinstead Lane
Barfield Park and Monks Avenue	• High sensitivity to groundwater emergence • Highway drainage at junction of Monks Avenue / Hadlow Way • Culverts on Monks Avenue and North Farm Road, and the railway culvert have some impact on water levels, but do not cause out of bank flows. • Maintenance of the Lancing Brooks
The Paddocks	• Siltation in the storage tanks, root infestation, and siltation in the ditch network. This has been cleared by WSCC during the past 18 months
West Beach Estate	• Gullies which are cracked/broken, or full of sediment, siltation in the surface water pipes along The Westway, and potential siltation of soakaways. • Blocked surface water drainage outfalls • High groundwater levels and tidal influence which affects discharge of runoff via soakaways
A27	• Condition of the piped drainage, which has since been addressed through remedial works undertaken by Highways England in 2013
Shoreham Airport	• Failure of the River Adur tidal wall during a tidal surge in December 2013. The Environment Agency is developing the business case for long term improvements to the tidal wall, and this is not considered further in this report.

Potential measures

In recent years, there has been a significant amount of work undertaken by WSCC, Adur and Worthing Councils, Southern Water and local residents to reduce flooding to people, property and infrastructure in Lancing. This has included:

- clearance of the Lancing Brooks in 2010 and 2013 by Adur and Worthing Councils and landowners, and further ditch clearance in the golf course development in January 2015;
- improvements to the foul sewerage network buy Southern Water, including development of an Infiltration Reduction Plan, sealing of the sewer network, installation of a level alert system, and production of an Emergency Action Plan;
- clearance of the surface water drainage near No. 4 Old Shoreham Road;
- works by local residents in West Beach Estate, and;
- de-silting of storage tanks and clearance of root infestation at The Paddocks.

Lancing Brooks in North Lancing

The SWMP has considered potential additional measures to reduce flood risk. The level of investment to mitigate flood risk must be proportional to the damage to property and infrastructure caused by flooding. In Lancing few properties are currently affected by internal flooding, and the proposed mitigation measures are reflective of this. Policy, construction and maintenance mitigation measures to alleviate the impacts of flooding in Lancing have been considered.

Even with all of these measures in place Lancing will still be at risk of flooding during more extreme weather events. This is because drainage systems (both natural and man-made) and any other flood risk infrastructure will become overwhelmed during extreme weather events. In addition, Lancing is highly vulnerable to groundwater flooding (or drainage is affected by groundwater levels), which is significantly more technically and economically challenging to manage.

In Grinstead Lane, Manor Way, Manor Close & Old Shoreham Road the proposed measures in the SWMP to manage flooding are:

- improve the management of surface water flows arriving at Grinstead Lane;
- Adur District Council to further consider the golf course development site;

- Southern Water to implement their Infiltration Reduction Plan (IRP) to reduce infiltration into the sewer network, and ensure measures are fully communicated with stakeholders and local residents;
- Southern Water to activate the Emergency Action Plan (EAP) when required;
- Adur Floodwatch Group and Adur District Council to work with local residents and communities to prepare individual and community flood plans, and;
- Adur District Council to discourage the use of new soakaway drainage unless site specific investigations demonstrate there is capacity with respect to groundwater levels. In certain areas soakaways will not function during periods of high groundwater levels and may also allow upward emergence of groundwater from the Chalk.

Within Barfield Park and Monks Avenue there are no significant proposed construction works related to highway or surface water drainage. For the properties which experience groundwater emergence it is recommended that roof and yard drainage is positively connected to the nearest drainage system (highway drainage or ditches), rather than to soakaways, and that soakaways are infilled to reduce the risk of groundwater emergence.

In addition there is evidence that the highway drainage at the junction of Monks Avenue and Hadlow Way results in garden flooding to one property. WSCC should investigate this further and clear any blocked gullies and/or install a new outlet into the ditch network.

On the West Beach Estate there are several quick win measures which should be taken forward by local residents with appropriate consent from the relevant landowners:

- enhanced maintenance of road gullies, several of which are cracked, broken or heavily silted;
- jetting of the pipe network and any soakaways where there is heavy siltation;
- uncover and clear the outfalls from the piped drainage on Boundary Road and Prince Avenue to enable discharge from the network, and;
- at the end of each outfall on Bristol Avenue, George V Avenue, Boundary Road and Prince Avenue it is recommended that a shallow depression be constructed to store flows from the Estate.

In addition, on The Broadway an option has been proposed to reduce flooding through additional gravity drainage. The details of this are presented in the main technical report and Appendix H.

Finally, the SWMP has developed an initial Water Level Management Plan to identify the short-term remedial measures, ongoing maintenance and monitoring which is required to improve the flows of the Lancing Brooks. This recommends improvement works at Old Salts Farm Road bridge, the Mash Barn Lane bridge and the Manor Close culvert. In addition the Water Level Management Plan outlines the need for vegetation clearance, monitoring of silt build-up, and de-silting (as required).

Implementation plan

It is recommended that within three months of publication of this report that WSCC produce an implementation plan. The implementation plan will set out who will undertake the recommended actions from the SWMP, the timetable for doing so, and the funding mechanism.