

**Ray Drabble**  
Flood Risk Engineer (Sustainable Drainage)  
Residents Services Highways & Transport  
T. 0330 222 4077  
F. 01243 836901  
[Ray.Drabble@westsussex.gov.uk](mailto:Ray.Drabble@westsussex.gov.uk)  
[www.westsussex.gov.uk](http://www.westsussex.gov.uk)

Western Area Office  
Drayton Depot  
Drayton Lane  
Drayton  
Nr Chichester  
West Sussex  
PO20 2AJ



Ben Daines  
Senior Planning Officer  
Adur & Worthing Councils  
Worthing Town Hall  
Chapel Road  
Worthing  
West Sussex, BN11 1HA

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**References:**

- A. Ben Worthing Sussex 5 Daines (Adur & Councils) email to West CC LLFA of 4 Jan 16.
- B. Tully De'Ath (Dec 2016) Flood Risk Assessment Issue 4- New Salts Farm – Shoreham 11649 For The Hyde Group.
- C. Ray Drabble (West Sussex CC LLFA) email to Ben Daines of 19 Dec 16.

Dear Ben,

**Pre-Application Query: Tully De'Ath Flood Risk Assessment Issue 4- New Salts Farm – Shoreham 11649 For The Hyde Group**

West Sussex County Council (WSCC) in its statutory capacity as Lead Local Flood Authority (LLFA) has been approached by Adur & Worthing Council (Reference A) for comments on the above.

West Sussex CC LLFA has reviewed the above document and this letter summarises our comments.

**General**

The stated purpose of the Flood Risk Assessment is to demonstrate to the Planners, the Environment Agency (EA) and West Sussex County Council as Lead Local Flood Authority that the proposed development is subject to an acceptable level of flood risk and should not increase the likelihood of flooding elsewhere (paragraph 1.2).

It achieves neither of these objectives as no detail has been provided of the catchment extent, greenfield run-off and post development run-off. This evidence is needed to demonstrate capacity in the drainage network commensurate with acceptable levels of flood risk to both the proposed development and to existing residents in the same drainage catchment. Recognising the particular constraints on

the drainage network that are characterised in the Lancing SWMP and Reference C, a full quantitative assessment of the pre and post-development run-off rates is needed to evaluate the depths of water for design storm events, consistent with the non-statutory technical standards.

The existing site is greenfield which currently infiltrates and discharges into the adjacent Lancing Brook system, depending on upon differing ground water scenarios. For the new development this will be replicated, with infiltration as the most representative existing method of surface water disposal. Where this is not possible discharge will be into the existing ditch network. The discharge into the ground will be confirmed via infiltration testing and run-off into the ditches will be controlled to replicate green-field run-off rates for a range of return periods. This requirement can be imposed as of a condition of planning.

The analyses will also need to take into consideration the effects both of tide-locking on the Lancing Brooks outfall and the tidal effects upon groundwater levels, both referred to in the FRA. Analyses should cover the full extent of the Lancing Brooks Catchment (Figure 3-2 of the SWMP) and, therefore, the post-development scenario for New Monks Farm that also feeds into the drainage network.

Tide locking and high ground water levels have been considered in the JBA assessment of the Lancing ditches. Additional updated modelling has been recently completed and the results are discussed later in this letter.

The Monks Farm development is located to the north of this site and discharges into the main Lancing Brook channel downstream the NSF site. It is assumed that the EA and the LLFA will impose greenfield run-off rates to the Monks Farm development, and as a consequence would have an insignificant effect on our analysis.

The interconnectivity of the Lancing Brooks and catchment-wide effects of tide-locking on the outfall reinforces the need for an FRA that considers the whole drainage catchment (as recommended to Tully De'Ath staff in summer 2016 by the EA). It is also consistent with best practice for phased developments set out in paragraph 7.2.4 of the SuDS Manual.

Within the NSF site there are two surface water disposal options available, infiltration and discharging to the Lancing ditches. For the majority of the time both methods will be used, however there will be occasions where infiltration will be the principle method of disposal, and periods when discharging to the ditch system will be appropriate. The drainage strategy developed accommodates both options. In addition, significant volumes of flood storage will be provided on the site when both options become limited. However, both discharge methods are tidal influenced and as a consequence one or both disposal methods are likely to be available during low tide scenarios. It is recognised that there can be infrequent exceedance events where both options may not be available for a longer than normal period of time and mitigation measures in terms of the unit types are designed to accommodate this exceedance scenario.

## **Specific Comments on text**

### *Paragraph 3.6 Groundwater*

West Sussex County Council Lead Local Flood Authority (WSCC LLFA) is concerned that the data provided for boreholes WLS 107-WLS 111 is not representative of typical overwinter conditions, having been taken between Sep 2016 and Nov 2016 when rainfall was below average for much of UK including the south. Given that infiltration is under consideration as part of the drainage strategy for New Salts farm, infiltration testing should be consistent with recommendations in BRE 365.

WSL4,5 & 6 have been installed for 12 months. They demonstrate that shallow infiltration would be possible for this area of the site throughout the year, although it is recognised that infiltration near WSL5 should be avoided due to regular high ground water levels. The monitoring of the ground water across the site will continue for the foreseeable future and the results will be used to confirm the detailed design.

With regards to infiltration, the ground water levels rise and fall with the tide which therefore demonstrates that the ground is suitable for infiltration. We have also discussed the suitability of infiltration with Southern Testing (Soils Engineers) who confirmed that based upon the intrusive investigation works undertaken to date shallow infiltration via the likes of permeable paving would be effective. During extreme high ground water events (at surface level) where infiltration performs in a less efficient manner conveyance swales are provided to accommodate temporary additional water. As part of the detailed design a BRE365 infiltration test will be undertaken where infiltration is to be used.

It should be noted that when the ground levels are particularly high the infiltration system would be able to connect to the Lancing ditch system.

### *Paragraph 4.1 – Development Proposals*

The proposals for green roofs with integral attenuation below (Blue Roof) is innovative and welcome but the attenuation & storage provided by this and other components of the proposed drainage needs to be calculated to demonstrate that greenfield run-off rates can be maintained.

Generally, infiltration will be used and consequently greenfield run-off calculations would not apply. However, during high ground water events, or when discharging to the Lancing Brooks ditches, flow control devices will be used to ensure the maximum run-off rate does not exceed the greenfield rate for a range of return periods. The details for the flow control devices would be developed in accordance with WSCC requirements and the guidance within the CIRA SuDS manual, all of which will be provided during the detailed design stage

The use of permeable paving for roads, parking courts and hard paved areas is considered to provide negligible benefit for critical groundwater and surface water flooding events, given the high groundwater levels associated with much of the development area.

As mentioned above for the majority of the time shallow infiltration should be possible. The sub-base material of the permeable roads will be designed to accommodate a 6 hour high ground water event (to match the tides) whilst

accommodating a 1 in 100+CC rainfall event. Shallow swales will be located adjacent to the road should an exceedance event occur, which link into the adjacent ditch drainage system.

### *5.3 Lancing Brooks Modelling*

This paragraph makes reference to Appendix Q, and modelling of both the 1 in 100+40% CC and the 1 in 1000-year return periods. Appendix Q only contains output images; without the methodology, catchment assessed, input values and other key parameters used to generate the model outputs, they are of no value to the assessment.

The new modelling of the Lancing Brooks has taken the raw data used in the original SWMP model (provided by CH2MHill) and JBA (who produced the ADUR SFRA) have undertaken a more detailed analysis in accordance with the requirements set down by the EA.

The results of the JBA analysis is summarised within the FRA. As the data is so large the modelling would need to be reviewed via a data file. We can provide the model to yourselves or if there is any specific output required please specify. This data will, also be reviewed by the EA.

We have attached an Explanation Note prepared by JBA which gives additional details of the modelling and confirms that the catchment is the same as the SWMP study area.

## *Section 6.0 Flood Management and Mitigation*

### *6.3 Floor Levels*

WSCC LLFA is concerned at the allowance of only 0.3m freeboard between ground floor level and the existing ground surface given the high risk of ground water / surface water flooding over parts of the site.

With reference to the Drainage Strategy drawing within the FRA there are significant bioretention areas/detention basins across the site which been located in areas which are designed to flood first.

With the ground floor level set at 300mm above the existing ground level it is not expected that anything other than an exceedance event would flood the ground floor. The ground floor areas will be used for garage/storage/utility areas, which will be constructed using flood resilient material. All habitable rooms will be a first floor level. However, FFL's to each dwelling will be assessed on an individual basis during detailed design with the opportunity for raising further should the localised topography dictate.

Additional modelling has been undertaken by JBA to establish the effects of reduced infiltration across the catchment area. This updated modelling assessment is based on a conservative assumption that only 50% of the catchment infiltrates i.e. 50% of the rainfall event will run off site to the surrounding Lancing Brooks network. Results indicating the depth of flooding (during a 100+CC event) including a tide lock scenario demonstrate that the majority of the site is free of flooding with

approximately 30% of the site area showing flooding up to the depth range of 10-200mm. It should be noted that these results are based on the current topography and doesn't allow for the raising localised areas or include any of the proposed mitigating measures such as conveyance swales and bioretention areas/detention basins. Refer to modelling output image "50% Run off with new channel and tide locking, 100yr+40% CC event"

### 6.5 Surface Water Run-off Rates

Consistent with the recommendations in the Lancing SWMP, WSCC LLFA would advise that infiltration into the subsoils is not an appropriate drainage measure for the site. It is unclear how / where water will be attenuated upstream of flow control devices; clarification should be sought.

Ground water monitoring indicates that shallow infiltration is possible and with over 12 months of monitoring on the eastern part of the site infiltration will work throughout the year. It is recognised that there may be periods of time or locations where infiltration will be less effective, in which case surface water will discharge to the Lancing Brook ditch system via a controlled outfall. The Drainage Strategy drawing within the FRA provides an indicative layout of new swale connections to the existing ditch network. Flow controls and non-return valves would be located at this junction, the details of which will be finalised as part of the detailed design.

### 6.8 Safe Access and Egress

*This states: it may not be possible to provide a dry means of escape from the buildings in the event of a flood. To overcome this the units will have direct access to the first floor, which will be the primary area for refuge in the event of a major coastal flood event.*

The above statement is not consistent with our interpretation of NPPF paragraph 103. If this response is to form part of the flood evacuation plan for all properties within New Salts Farm, how are disabled residents being accommodated for?

All units only have accommodation at first floor level and above. Consequently, any wheel chair residents would already have access to the higher levels. This approach has been accepted on a number of other schemes within Adur.

### 6.10 Foul Sewers

Confirmation needs to be sought by A&WC from Southern Water whether the proposed infrastructure measures outlined in Appendix C will provide sufficient capacity to address the proposed new development, existing sewerage flooding issues and take into consideration the Southern Water measures proposed to accommodate the allocation of 600 homes at New Monks Farm. Specifically, confirmation from Southern Water should be sought that they have strategically reviewed all the proposed development affecting this sewerage catchment and can

provide the capacity needed within the timescale that development is being brought forward.

No reference is made to the issue of groundwater inundation of the foul system and we assess this as being a significant risk. Inundation may result from hydrostatic pressure on the existing foul drains as well as excessive surface water draining down through any existing or new foul sewer manholes. This risk needs to be considered and appropriate mitigation put in place.

Southern Water have undertaken a capacity assessment of their sewerage system and it is for them to comment on what they have allowed for in their analysis. However, it is our experience that an allowance for surface/ground water ingress into the sewerage is included within their capacity calculations. Likewise, any new development which has been included within the Local Development Plan would also be included as a matter of course.

The NSF development will provide a new foul drainage system within the site and as a consequence we can control the pipe and jointing specification for the private drainage system. As part of the detailed design stage additional testing can be undertaken to establish if an enhanced jointing specification is required. However it is anticipated that much of the new foul system will be offered for adoption by Southern Water and as a consequence the detailing of the drainage system would need to be agreed with them.

### 13.0 Conclusion

The conclusion states that: *the main flood risk for the development is associated with coastal flooding.* This statement and the tenor of the FRA, as a whole, in our view underplay the significant flood risk from groundwater and surface water.

The site conditions are summarised in paragraph 3.4.2 of the Lancing SWMP that states:

*Under conditions of high winter recharge and elevated groundwater levels in the Chalk and in response to upward groundwater pressure from the underlying Chalk, there may be upward leakage from the Chalk to the upper aquifer and surface water. This occurs through more permeable windows in the Superficial Deposits... Where there is partial connectivity between the two aquifers, the upper alluvial aquifer may become more permanently saturated, leading to areas of marshy ground. These mechanisms are most likely to occur in the southern part of the study area.*

It is these conditions of saturated ground water in combination with prolonged rainfall that present a significant issue for surface water drainage for the site and for existing residences in adjacent areas that rely upon the same drainage network. The FRA has not demonstrated that surface water under these conditions can be adequately drained without causing increased flood risk to existing residents in the catchment or risking flooding of the proposed residential properties.

There are two methods of surface water disposal for the site. The SWMP states that the ditches are only partially influenced by high ground water and the Lancing Brooks system has been modelled to replicate 1 in 100 +CC event without flooding the site in a tide lock scenario.

Additional modelling has been undertaken by JBA to establish the effects of reduced infiltration across the catchment area. This updated modelling assessment is based on a conservative assumption that only 50% of the catchment infiltrates i.e. 50% of the rainfall event will run off site to the surrounding Lancing Brooks network. Results indicating the depth of flooding (during a 100+CC event) including a tide lock scenario demonstrate that the majority of the site is free of flooding with approximately 30% of the site area showing flooding up to the depth range of 10-200mm.

Significant areas on the site are to be proved to accommodate surface flooding and exceedance flood events have been considered within the design of the unit types. Any surface flooding on the site would be held within it and the additional ditch network proposed combined with enhanced levels of maintenance provided to the ditches should reduce the flood risk for the adjacent residential areas.

It is recognised that the FRA does not have the same level of detail that would normally be required for a planning application. However, it should be noted that the purpose of this FRA is to advise on the suitability of the New Salts Farm to be allocated within the Local Development Plan. Within any future planning application, a detailed FRA prepared in accordance with the requirements of NPPF. However, we believe there is sufficient detail (with the provision of the additional Lancing Brooks modelling discussed above) to demonstrate that a development on the New Slats Farm could be designed such that it would not pose an unacceptable level of flood risk both within and beyond the site.

Yours sincerely

Ray Drabble  
Flood Risk Engineer (Sustainable Drainage)  
West Sussex Lead Local Flood Authority

Copies to: Adrian Jackson, Environment Agency

Internal: Caroline West, West Sussex County Council