

Land North of Sinah Lane: Tide locking and Recent SuDS Changes

In the Pre-sub Local Plan 2036 it is stated that just one of the many constraints of the site (H29) included the '*complex drainage system in the area - affected by tide locking, coastal change and tight levels; likely to require drainage solutions and maintenance of systems beyond site boundary*'.

Tide Locking

This is a complex process with regards to groundwater (underground fresh water) in coastal areas. The effects of not only the Moon but also the pressure changes around the coast due the tidal movements of the ocean, all play a part. However, for the purposes of critiquing the SuDS proposed for this site, it should be noted that there has been recognition that the water within the site rises when the tide comes in and falls when the tide goes out. This is why the site is designated as 'affected by tide locking' - the water of the harbour and the water of the site are linked.

Recent SuDS Changes

The newly amended drainage plan was discovered in the detail of the recent Flood Risk Assessment (FRA). This document was only produced in March 2020 just before the original date for the DMC for this site, giving no time for the scrutiny it needs. As this DMC was postponed, due to Covid-19, we have had time to look at the details. In earlier correspondence regarding the site, I had identified to the planners that no record of a Specific FRA or Exception Test for the site had been produced, yet these were clearly required due to the size of the site and the coastal boundary of the proposed onsite refuge area is in flood zone 3.

In the original proposal, to deal with the overflow from the attenuation pond, Southern Water's infrastructure was to be involved but **this has been changed after rejection from Southern Water**, as described in the recent FRA. It will now be draining out into Langstone Harbour!!

The drainage plan is now as follows:

- 1st to pump and hold water within a raised attenuation pond
- 2nd to allow the overflow from this to go northwards offsite via the existing drainage ditches (currently overgrown and needing continuous maintenance to be effective)
- 3rd to drain into an offsite previously untouched ancient natural pond (at the Northern boundary of the site containing rich ecology)
- 4th to flow through another offsite ditch adjacent and seeping into the saltmarsh
- 5th to eventually drain into the Langstone Harbour (deceptively avoiding this name in the FRA by stating 'Sinah Lake', a lesser known *channel* within Langstone Harbour) via the drainage outlets that frequently become blocked by the pebbles on the eroded west coast next to the rare habitat of the saltmarsh.

Bodies of Water Affecting the Site

It is imperative to understand that this site itself is affected by 3 separate (but closely interlinked) bodies of water, one of which is hidden underground and all of which cause flooding now and in the near future:

1. Langstone Harbour – borders the site and is internationally protected RAMSAR, SPA, SSSI etc

2. Surface water – especially after heavy rainfall in the winter months which currently
 - does not drain away quickly in any particular direction
 - percolates downwards very slowly due to high water table
 - slowly evaporates therefore reducing the pressure on other drainage infrastructure for the area
 - will include polluted hard surface run off post development

3. Fresh ‘groundwater’ that runs **under** the field which we discovered when servicing a soakaway in our back garden (adjacent to the field). The council has also recognised this fact due to data recorded from measurements taken from this field in the last few years.
This fresh groundwater
 - lies only about 1m to 0.45m below ground level in sandy, shallow superficial deposits which are porous than the surrounding London Clay
 - links to the surface water especially at times of heavy rainfall due to percolation
 - rises and falls with the tide due to tidal forces
 - is continually replenished and this will increase with Climate Change
 - is most likely derived from surface water, precipitation and with some contribution from sandy layers/lenses within the London Clay Formation. Groundwater is likely to be perched on a low permeability horizon, i.e. the London Clay Formation
 - may receive a small contribution from the Chalk Aquifer. The Chalk receives recharge from rainfall at surface, overlying superficial deposits and the Chalk bedrock aquifer of the South Downs

Clay Layer Compromise

The site has a less permeable clay layer just below the surface of the field that currently separates surface water from the fresh groundwater below the surface. This will be compromised by the development.

The clay will be punctured by man-made structures such as housing foundations, which necessarily go deeper than 1m, creating a link connecting the groundwater to the surface. Therefore what would have been two fairly distinct bodies of water - (a) surface water and (b) confined underground fresh groundwater - will instead become directly connected. Once these connections are made, the squeezing effect from the tide locking and the sucking effect from the pumping of the surface water will mean that both bodies of water will be as one.

Whilst the compromising and puncturing of the clay layer between groundwater and surface water has already happened across Hayling due to the houses that are already built, there is a huge difference between the drainage techniques already in use such as soakaways etc. and this site’s proposed SuDS. Soakaways allow water from the surface to drain down (percolate) underground but the proposed SuDS for H29 development will instead be pumping water up and out of the area.

It has already been recognised that soakaways are not effective enough drainage due to the fact that the drained surface water meets the underground water about 1m below ground level, so pumping the water has been put forward as an alternative solution. However with the connection between surface water and groundwater being made, the pumping of this surface water will include groundwater that has risen to the surface and the SuDS will be attempting to pump it up and out.

Furthermore, as the site is 'affected by tide locking', this endless supply will be exacerbated during high tides, spring tides, low pressure storm systems, rising sea levels and in particular, high levels of rainfall (all events that are further amplified with climate change).

Subsidence

The continual pumping, disturbance and extraction of groundwater is a known cause of subsidence. This is a potential issue for this site (H29). Already on Hayling, there has been drainage, water supply and sewerage infrastructure breakdown due to old pipes cracking due to the superficial deposit movement. Sink holes developed under the A3023 in the location of the burst water pipes in 2019.

Rate of Overflow

Post development, holding the combination of ground and surface water onsite is not possible - especially in the winter. In any case, once the capacity of the onsite attenuation pond has been reached, any additional water then entering the system will initiate the overflow measures and will need to be moved offsite at the same rate it enters to avoid flooding.

For example, during a rainstorm, once the attenuation pond reaches capacity, the SuDS will need to move water offsite at the same rate and volume that the storm is generating.

The vast volume and rate of this overflow will overwhelm any filtration system allowing unfiltered water into offsite areas. Not only will this contaminated water reach Langstone Harbour, it will destroy the saltmarsh and other natural pond habitats by forcing them to accept water containing decades of farming fertiliser along with pollutants and nutrients from households and building processes. This is similar to what happens to Southern Water's raw sewage after high rainfall in what some describe as a 'licensed discharge', others would describe this as a reasonably foreseeable failure of planning and insufficient infrastructure capacity - certainly not a starting point for development.

Suitability

This SuDS might well be suitable inland and away from any groundwater systems but pumping a site that: is coastal and known to be tide locked; is a surface water 'reservoir'; has groundwater systems close to the surface; is surrounded by previously untouched habitats that are sensitive ecologically which the SuDS is to overflow into, seems highly inappropriate.

Offsite Impact

There are huge ramifications of the SuDS for ALL adjacent **offsite** areas:-

- to the North East, the saltmarsh will be destroyed by the polluted and nutrient rich overflow from the SuDS
- to the North West, Langstone Harbour will be receiving this same nutrient rich and polluting overflow
- South and West homes will become reliant on the robustness of the pumping systems to avoid flooding as their drainage will be linked to the H29 site.
- to the East, the Hayling Billy Trail will be impacted by changes to the saltmarsh and will also become reliant on the robustness of the pumping systems.

The use of Langstone Harbour (Sinah Lake) as the destination of this overflow is clearly undesirable. It is surprising however that if this is to be the destination of the water, why is

the overflow directed 1st into offsite untouched areas such as the ancient pond and saltmarsh. This site has a long boundary with the harbour, if filters were good enough to prevent contaminated water moving offsite then why not drain straight out into the harbour? It is both needless and unacceptable to destroy these offsite areas simply to hide the uncomfortable truth about the final destination of this overflow.

It is also highly likely that these changes to the Flood Risk Assessment are yet to be reviewed by consultees such as Natural England, Environment Agency and the Langstone Harbour Board - the change from first believing that Southern Water would likely deal with the overflow, to the plan now being to direct flow offsite to Langstone Harbour has clear ecological consequences.

A few other points that need addressing:-

- there is no clear future management of SuDS system lined up
- Southern Water has not taken responsibility for this system so the presumptions of the consultees have not been realised and they therefore need informing
- As the level of the harbour and the level of the water within the site are linked, pumping one into the other may well prove futile in reducing the amount of water in the site

Summary of potential Effects

Potential Effects of the Proposed SuDS	Cause
Direct discharge into Langstone Harbour SPA, RAMSAR (nutrient neutrality etc.)	SuDS will overflow into Langstone Harbour with polluted and nutrient rich water, full of man-made contaminants. In order to prevent flooding, discharge will need to be at such a rate as to overwhelm any filtration in place (similar to Southern Water's discharge of raw sewage directly into Langstone Harbour post rainfall)
Ecological disturbance to offsite pond	SuDS will overflow into this untouched pond with polluted and nutrient rich water, full of man-made contaminants forever changing the ecology of this area (has there been a survey of this pond to ascertain the ecology and potential protected species such as great crested newts etc?)
Ecological disturbance of offsite saltmarsh	Drainage channels for the SuDS overflow will allow seepage into the adjacent saltmarsh with polluted and nutrient rich water, full of man-made contaminants forever changing the ecology of this area
Subsidence and sinkholes affecting buildings and infrastructure (onsite and offsite)	Possible compromise and movement of the clay layer from the effects of pumping that draws up previously confined fresh groundwater to the surface along with squeezing and pressure changes driven by tide locked bodies of water

Flooding of adjacent properties	Currently the field holds on to a vast capacity of water post rainfall which will be replaced by hard surfaces. Should any part of the SuDS fail or a blockage occur in the drainage channel, properties on and around the site will be flooded
Flooding of Hayling Billy Trail and bird refuge	Currently the field holds on to a vast capacity of water post rainfall which will be replaced by hard surfaces. Should any part of the SuDS fail or a blockage occur in the drainage channel, the nature trail and bird refuges will be flooded with man-made contaminants
Mosquito population will increase	The onsite attenuation pond will likely provide the perfect environment for mosquitoes to thrive, exacerbating an existing issue. If this attenuation pond is treated with pesticides to control mosquitoes, this will contaminate surrounding refuges and sensitive offsite ecology (Billy Trail, offsite pond, saltmarsh, Langstone Harbour etc.)
Ongoing management fees	To keep this development feasible, the SuDS will need to continually function creating reliance and requiring significant and ongoing management and maintenance costs.
Legal action and consequences	Should any surrounding properties be detrimentally affected by the reasonably foreseeable impacts of this SuDS, residence of adjacent properties will no doubt pursue legal action
SuDS is found to be unworkable post development	If there is found to be a fundamental inability to overcome the practicalities relating to: the relationship in water levels between Langstone Harbour, field groundwater and surface water or simply the effect of sea level rise and climate change; then the ramifications could be disastrous for not only the surrounding community but financially for the entire borough

Articles that may be of interest

<https://www.nature.com/articles/s41598-020-60762-4>

<https://theconversation.com/squeezed-by-gravity-how-tides-affect-the-groundwater-under-our-feet-74928>

https://en.wikipedia.org/wiki/Groundwater-related_subsidence

<https://projectblue.blob.core.windows.net/media/Default/Imported%20Publication%20Docs/Field%20drainage%20guide%200818.pdf>

