Proposed Site Allocation, Breadsell Lane, Hastings, East Sussex.

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Surface Water Strategy

Issue B

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Proposed Housing Allocation – Breadsell Lane

1.00 Introduction

1.01 This report has been prepared to consider the impact that development may have on the SSSI adjacent to the site. This is considered a potential constraint to the allocation of this land in the Hastings Borough Council Core Strategy.

1.02 The report goes into sufficient detail to show how the run-off from the development can be managed so as to prevent pollution to the watercourse running through the SSSI. The report will also show how sustainable drainage methods can be utilised to maintain or improve the flows in this watercourse.

1.03 The draft Core Strategy of the Hastings Borough Council Local Development Framework originally identified the site at Breadsell Lane as a strategic site for the Council to achieve its housing target over the plan period. The Council has since reduced the number of new houses over the plan period so the need for this site has been lessened. However, the Council is aware that not all identified sites may come forward in the plan period and therefore are still considering the site at Breadsell Lane, albeit the development may be on a smaller scale than originally proposed.

1.04 Natural England have raised concerns and objections to the site due to its location close to the SSSI and have stated that they would object to development in this location unless investigations in to current river flows and groundwater levels are undertaken.

1.05 Options are proposed which will ensure the flows in the watercourse can be maintained which are independent of the development.

2.00 Sustainable Drainage: General Principles

2.01 The new Flood and Water Management Act requires the implementation of sustainable drainage techniques in order to reduce pollution and to restrict the surface water run-off generated from new development.

2.02 It is now expected that new developments will be designed so that run-off rates will be no greater than that from the green field situation, and that pollution control measures are included which will remove the risk of pollution to the water environment. The site at Breadsell Lane is an ideal opportunity to incorporate a number of sustainable drainage techniques to achieve these aims and to enhance the existing biodiversity through the construction of new ponds and reed beds.

2.03 There is an agreed hierarchy of sustainable drainage techniques which should be used when designing a sustainable drainage system:

- Infiltration to ground
- Re-use of water (rainwater harvesting)
- Discharge to watercourses using above ground attenuation (eg. ponds)

- Discharge to watercourses using below ground attenuation (eg. tanks)
- Discharge to surface water sewers using above ground attenuation
- Discharge to surface waters sewers using below ground attenuation
- Discharge to combined sewers using above ground attenuation
- Discharge to combined sewers using above ground attenuation

The site at Breadsell Lane will use only techniques utilising the top three solutions so maximising the sustainable drainage benefits. This can be achieved by ensuring the requirements of sustainable drainage are included at the very earliest stages of design and allowing sufficient space within the development to incorporate the most appropriate solutions. The Sustainable Drainage Systems (SUDS) Manual published by CIRIA will be an essential tool in deciding which are the most appropriate techniques to maximise the benefits and minimise the risks associated with surface water drainage of new developments.

2.04 The design of the development at Breadsell Lane will also ensure the run-off rate will not exceed the green field conditions, and will actually provide a reduction in the peak green field discharge rate, as it will be limited to the 1 in 1 year discharge rate. Pollution control measures will also be introduced, such as reed beds, so that overall we would expect pollution to the watercourse will be lower than the current situation.

2.05 It is evident that surface water drainage schemes serving older developments did not conform to these standards, as can be seen even in the relatively new development on the other side of the valley from the Breadsell Lane site. In this development, the use of permeable paving is absent (many driveways are blocked paved but these do not necessarily allow all rainwater to percolate in to the sub base), and surface water discharges are via point outlets to the watercourse running through the SSSI and as a result can and do cause pollution to this watercourse.

3.00 Objection from Natural England

3.01 It is the responsibility of Natural England to protect the natural environment and particularly Sites of Special Scientific Interest (SSSI) such as the Marline Valley Woods SSSI which is adjacent to the proposed site. However, we believe it is unreasonable to object to the proposal solely on the basis of a lack of current hydrological and hydrogeological information.

3.02 This data would provide information on the current situation, but this would or should not affect any future decision about the use of land for development without knowing how it is proposed the development will be managed to ensure groundwater levels and surface water run-off are maintained at existing levels. Groundwater levels will reflect rainfall patterns over the period in question but unless these are measured over a long period, they can be misleading if for instance rainfall had been well below or above normal. Similarly, water quality in the watercourse and groundwater will reflect current use of the land, and this again will depend whether the ground has been used for pasture or arable use. Point pollution from the surface water outlets from the development on the opposite side of the valley will also have an impact on water quality, and would be dependent on rainfall patterns and when samples are taken.

3.03 It is agreed that having some form of baseline will be beneficial as a means of future comparison, but the decision on whether development should proceed can only be taken when the impact of development is assessed. The use of sustainable drainage techniques has and is being further developed so that the natural water environment is not affected from development and potentially an improvement can be made through more managed systems.

3.04 The original development proposals covered an area which was equivalent to 27% of the total catchment area for the watercourse running through the SSSI. The revised Masterplan is significantly smaller and covers 13% of the total catchment, when the area within the Rother District Council is included, and approximately 10% when only the land within Hastings BC is considered.

3.05 We do not under estimate the potential impact of development on the SSSI but we would consider the mitigation measures which will be included in the design together with the much smaller development area does not justify a blanket objection to this site.

4.00 Options to ensure hydrological function is maintained

4.01 The watercourse running through the SSSI is fed from two sources: Surface water run-off and from groundwater. The design of the development must ensure that the development does not adversely impact on either of these two sources.

Groundwater flows

4.02 The base flows in the watercourses through the SSSI will be reliant on groundwater and therefore it will be essential to ensure these are not jeopardised by the development. A number of techniques can be used to ensure at least the same if not more water falling on the ground is recharged to groundwater.

4.03 This can be achieved by incorporating infiltration techniques for all impermeable areas such as roads, parking areas and roofs.

4.04 All parking areas, driveways and private accesses should be constructed using permeable paving. The sub base should be of sufficient depth so that the 1 in 100 year plus climate change rainfall event can be stored in the sub base, which can then infiltrate in to the ground and feed in to the groundwater. The permeable paving and porous sub base will allow more water to be stored and to infiltrate into the ground than would be the case for the green field situation due to the depth of the highly porous sub base.

4.05 The porous sub base can include a membrane to remove pollutants, whilst the distance between the base of the sub base and the groundwater will further allow pollutants to be removed via natural processes before they can affect the groundwater.

4.06 All roof water should be connected to soakaways which similarly are designed to cater for the 1 in 100 year plus climate change event. It is possible that the rate of infiltration will not be sufficient to meet Building Regulation standards so that overflows will be provided which will transfer any excess water to the storage ponds at the bottom of the site. Again, the provision of large soakaways, designed for the most extreme event, will maximise the amount of water that can infiltrate in to the ground which again will be to a greater extent than is currently the case.

4.07 Road drainage will fall in to two categories, the major spine roads and the estate roads. The spine roads can be constructed with swales which are not only excellent at removing pollution but also allow water to infiltrate in to the ground. The degree of infiltration can be again maximised by constructing the swale with a french drain arrangement at the bottom which stores water and maximises the surface area over which infiltration can occur. The swales will be linked so that any excess water will similarly be transferred to the storage ponds at the bottom of the site.

4.08 It is not usually practical to use swales on estate roads as the number of vehicle crossings makes this solution impractical. In this case, the road can be constructed using permeable paving or porous asphalt depending on what is acceptable to the Highway Authority. Whilst such techniques were formally not often adopted by Highway Authorities, the transfer of drainage responsibilities to County Councils and Unitary Authorities means there will be more co-ordination in this area. The sub base will again be designed to store the 1 in 100 year plus climate change event but will need to have a drainage arrangement that will allow water that does not infiltrate in to the ground to be stored downstream in the storage ponds. This can be through overflow pipes connecting to a piped network.

4.09 A specialised membrane would be used in the construction to remove any pollutants, the same as mentioned in section 4.6.

4.10 Alternatively, the estate roads could drain to standard soakaways, which again would have linked overflows should the infiltration rate be lower than the required standard. The soakaways would again be designed to store the 1 in 100 year plus climate change event ensuring the maximum amount of rainfall can infiltrate to the groundwater. The road would be drained via trapped gullies to remove the worst of the pollutants.

4.11 The designs for the impermeable areas can ensure a greater volume of water can potentially infiltrate in to the ground as storage will be provided for the 1 in 100 year plus climate change event, whilst in the green field situation more of this water will run-off as will be shown in the following sections. The quality of the groundwater can be protected by ensuring the appropriate safeguards are in place, such as specialised membranes, trapped gullies and natural processes in the ground.

4.12 These construction methods will ensure the volume of water that can feed into the groundwater will be greater than the existing green field situation and will therefore ensure the base flow to the watercourse is maintained to at least its current level.

Surface Water Run-off

4.13 The site is currently used for farming, both arable and pasture, but also includes areas of woodland. The areas of woodland will remain unchanged and will be retained as part of the landscaping scheme. The run-off from the fields will occur when the soil is unable to accommodate any further rainfall and is dependant on both soil types and rainfall intensities. The more extreme storm events will generate greater surface water discharges which is what would naturally be expected. The method of estimating the surface water run-off is based on the Institute of Hydrology equation for sites under 50 hectares, as specified in the SUDS Manual. The run-off is calculated initially for a site of 50 hectares which can then be divided by 50 to give a run-off rate per hectare.

4.14 The calculations for existing surface water run-off are included in Appendix B and show that the run-off increases from 3.4 l/s per hectare for the 1 year event to 12.6 l/s for the 1 in 100 year event. This confirms the comments made above about the amount of water that would run-off for the more extreme event whereas if additional storage is provided for the infiltration systems, this water will have the opportunity of infiltrating the ground.

4.15 Whilst an infiltration system would be the ideal solution for this, and any new development, the ground conditions may not enable all the water to infiltrate in to the ground. An overflow system may need to be provided to drain any water that exceeds the capacity of the infiltration system. This could occur if a second severe storm occurred before the water from a preceding storm had a chance to drain away. If the infiltration is particularly poor, it may take several days for the system to drain by 50%.

4.16 Any water exceeding the capacity of the infiltration system will be transferred to surface attenuation ponds, which will then have a controlled outlet to the watercourse in the SSSI.

4.17 Surface water run-off from the development will be restricted to the 1 in 1 year event which will prevent flood flows and increase the time when water is flowing down the watercourse. The size of the storage ponds, in the worst scenario, would be based on the assumption that the infiltration systems are full at the time of the critical storm although this is likely to result in a significant over design of the storage ponds. The attenuation calculations also included in Appendix B show that the attenuation ponds would need to hold approximately 4750 cubic metres of water. The area designated for the attenuation ponds is nearly 12000 sq metres so it is clear there would be sufficient space for the ponds and associated reed beds. It should also be remembered that approximately 8000 cubic metres of storage will be provided upstream of the attenuation ponds as part of the SUDS infiltration systems.

4.18 The ponds could also be used as a means of feeding water in to the watercourses during low flow periods. If the ponds are over designed then water can be stored and then allowed to drain in to the watercourse when flows fall below a certain limit. Obviously the extent to which this enhancement to flows can be achieved will be dependent on the volume of water available but could result in a positive enhancement to the general quality of the watercourse.

4.19 A reed bed would also be constructed prior to the storage ponds to remove any pollutants and ensure water quality to the watercourse is maintained if not improved over the current situation.

5.00 Other Improvements

5.01 In order to further safeguard the flows through the SSSI, it is proposed a borehole is drilled which will then be used to supply water to the top end of the watercourse at an agreed rate. The location of such a borehole and the consent to abstract water for such a purpose would need to be agreed with the Environment Agency, but it would be preferable if the borehole could be situated in the development site. The volume of water is likely to be in the order of 15 – 60 l/min depending on the conditions stipulated by the Environment Agency. Whilst the Agency is concerned about over abstraction in the Ashdown Beds, this water would be used to directly feed a watercourse during low flow periods so would have direct environmental benefits.

5.02 The borehole would be able to supply water to the watercourse during low flow periods when otherwise the stream would be dry or at very low flow levels, particularly at the top end of the stream. This water supply would enhance and improve the current water habitat through the SSSI which is seen as a major factor for the safeguarding of the bryophyte species.

5.03 The detailed design of the drainage system serving the new development will maintain the current hydrogeological conditions and should therefore have no detrimental impact on the watercourse. However, the additional ability to input additional water when otherwise flows would be low or non-existent could be of great benefit to the SSSI. A site visit was undertaken in December 2011 when it would be expected that flows in the watercourse would have been at their peak. However, due to the low rainfall in the preceding month, the main tributaries were dry until the channels were close to the bottom of the valley. This situation could be dramatically improved with the provision of this borehole feed.

5.04 It will be necessary to gain approval from the Environment Agency, and they have been contacted for their initial comments, but none have so far been received before this report was written.

5.05 The surface water drains serving the estate on the eastern side of the valley drain to the watercourse via a few large outfalls. These result in rapid transfer of pollutants to the watercourse and result in a deterioration of water quality. As part of the approval of the site at Breadsell Lane, a requirement could be made of the developer to install reed beds at the end of the outfalls to reduce the amount of pollutants reaching the watercourse. These reed beds would have to be constructed within the SSSI unless agreement was reached with Southern Water to shorten the outfalls and construct the reed beds on the edge of the SSSI. Nevertheless, any such initiative would improve the water quality and improve the condition of the watercourse running through the SSSI.

6.00 Rigare Ltd Report

6.01 Rigare Ltd has produced a scoping level hydrological and hydrogeological report for Hastings Borough Council in December 2009 on the whole development site. This report identified existing geological and hydrogeological features from site auger surveys and from this arrived at some conceptual understanding of the hydrology of the site.

6.02 The conclusions of the hydrology were that: Generally poorly permeable topsoils and relatively steep gradients leads to a higher proportion of effective rainfall running off directly over the ground to the stream than infiltrates the ground to become groundwater. This would become more prevalent over the outcrop of Wadhurst Clay and conversely less where the site lies on the outcrop of Ashdown Beds.

6.03 There are a number of mapped springs which at the time of the Rigare survey were not running at the time Rigare undertook their site survey, and similarly these springs were not evident on our site visit in December 2011. The report suggests this is evidence that the water table fluctuates over a wide annual range, which we agree is reasonable.

6.04 We do not disagree with the general findings pf the report but do have some concerns over the preliminary assessment of the hydrological and hydrogeological impacts of developing the site:

- Spatial and temporal distribution of the quantity of surface water run-off. *The report suggests this is at risk through acceleration and re-direction of run-off from hard standing and through subsurface drainage networks:* We would suggest that by directing surface water run-off to infiltration systems this will reduce the time over which surface water will be discharged and whilst the Masterplan currently shows the attenuation ponds at the bottom of the site, these could be distributed along the site, so the run-off can be directed to similar locations as existing.

- Quality of surface water run-off. *The report suggests this is at risk from additions of contaminants during and after construction.* Whilst there is a risk of contaminants, we would suggest that specific pollution prevention measures will be employed to minimise this risk. It would also be reasonable to suppose that the Environment Agency will require strict pollution prevention measures during and post construction to protect both surface water and groundwater quality. The report from Rigare also does not include the current risk of surface water pollution from the use of fertilisers and pesticides which can be used on the agricultural land. The high level of surface water run-off would suggest that much of the fertiliser and pesticides could be washed off in to the stream.
- Spatial and temporal distribution of groundwater recharge. *The report suggests this is at risk from the potential change in surface infiltration capacity from the laying of lower permeability surfaces notwithstanding the probable use of SUDS techniques*. This report has highlighted the potential for actually increasing the degree of infiltration by ensuring all rainfall is directed to the ground with increased capacity for infiltration than exists in the existing topsoil and substrata.
- Groundwater quality. *As for surface water, the report suggests this could be at risk from the addition of contaminants.* Our argument above on surface water quality applies equally to groundwater quality.

6.05 We do not underestimate the potential difficulties and risks associated with a development at this location, and whilst this report primarily highlights the negative aspects of the development, it does state *"It should be possible to maintain SSSI bryophyte interest alongside development off Breadsell Lane provided the quantity and quality existing surface water and groundwater discharges from the site are maintained and any increase in recreational pressure on the SSSI is managed properly."* We are proposing that SUDS should be an integral and essential tool to ensure the hydrology and hydrogeology of the existing green field situation is maintained and in fact improved to increase the base flows to the watercourse.

6.06 The report also ignores the risk to the hydrology and water quality from the existing situation. Fertilisers and pesticides are widespread on agricultural land and these are more likely to be a major source of contaminants to both surface and groundwater than from a properly designed SUDS system.

7.00 Future work

7.01 The design of the sustainable drainage system will depend on the infiltration rate of the underlying ground. The higher the infiltration rate the less the need for an overflow system and vice versa, if the infiltration rate is very low, the overflow system will be more significant. A number of infiltration tests should be undertaken to determine the infiltration rate at various locations in the site and a number of locations are identified in the plan in Appendix C.

7.02 A borehole is proposed which will enable the flows in the watercourse through the SSSI to be augmented during low flow periods. The borehole will be sited at an agreed location and abstraction rate with the Environment Agency and Natural England.

8.00 Summary Comments

8.01 Hastings Borough Council had initially identified the site at Breadsell Lane to be an integral part of the land required to meet the forecast housing requirements over the plan period.

8.02 The Borough has reduced the number of houses to be constructed over the plan period and as a result the need for the development at Breadsell Lane has been reduced. However, Hastings BC know that not all identified sites will come forward so are still considering the Breadsell Lane site, potentially on a smaller scale.

8.03 The site is adjacent to the Marline Woods SSSI and objections have been raised by Natural England that the site should not be allocated until base hydrological and hydrogeological studies have taken place. These are extremely expensive to undertake and would provide base information of the current situation, but this in itself does not provide reasons to either support or object to the development of the site. What is crucial is whether the development can be constructed so that it will not be detrimental, and if possible could provide enhancements to the SSSI.

8.04 This site offers the opportunity to design and build a development with sustainability at its very core. This does not just apply to the energy efficient nature of the houses themselves but other issues such as sustainable drainage, energy generation, reduced water consumption, sustainable transport etc.

8.05 This report has concentrated on the sustainable drainage issues as these are the primary concern of Natural England. The sustainable drainage methods proposed in this report are recognised and well established, but other methods may arise in the future which could supersede these current proposals.

8.06 The base flow in the watercourse through the SSSI is generated primarily from groundwater and it is this element which needs to be safeguarded. Development does reduce the permeable surface area from the green field situation which could reduce the volume of water infiltrating to the groundwater if no remedial actions are undertaken.

8.07 We recognise that the impermeable area must be similarly drained to the ground, and we have proposed that all impermeable areas are initially connected to infiltration systems that are designed to store the 1 in 100 year plus climate change rainfall event. The capacity of these infiltration systems, whether they are porous sub base, soakaways or french drains, will be greater than the green field situation so more water will have the chance to infiltrate in to the groundwater.

8.08 Pollution prevention measures will also be introduced including specialised membranes, trapped gullies, interceptors, reed beds and natural soil processes so that water quality can be maintained if not improved as, at the moment, pesticides and fertilisers used on the farm land can easily be transferred to the water environment.

8.09 The infiltration systems would have overflow systems draining to open storage ponds at the bottom of the site. These overflow system are provided where infiltration rates are low and water may not drain as quickly as would be required for Building Regulation purposes. The storage ponds can be oversized to allow water to be fed in to the watercourse during low flow periods if water is available.

8.10 An augmentation borehole is proposed which will supply additional flows into the top of the watercourse during low flow periods. This will provide a significant improvement over the current situation where the watercourse, particularly along the upper sections, does dry up during low rainfall periods. The borehole location and abstraction rate would need to be agreed with both the Environment Agency and Natural England.

8.11 In summary, the sustainable drainage methods will ensure the site replicates the green field situation and will in fact seek to increase the amount of rainfall that infiltrates in to the ground. The augmentation borehole will ensure minimum acceptable flows in the watercourse are maintained the whole year, whereas currently the stream can be dry in the upper reaches with extremely low flows downstream after periods of low rainfall. The augmentation feed will maintain these minimum flows, which will ensure the habitat is safeguarded for the bryophyte species.

Appendix A – Location and MasterPlan

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Project:	Breadsell Lane, NW Hastings
Dwg. Title:	Hastings Core Strategy Masterplan 2 **FOR PLANNING PURPOSES ONLY**
Scale:	1:2500 @A1
Date:	November 2011
Drawn by:	CPA
Dwg:	08/108/05
Rev.	
Project Manager:	JW

Appendix B – Green Field Run-Off Rates
Attenuation Storage

Breadsell Lane, Hastings
Estimate of Green Field Run off-rates using Institute of Hyrology Equation

IoH
Q bar
0.00108 Area$^{0.89}$xSAAR$^{1.17}$ x SOIL$^{2.17}$

Area	0.5	
Area$^{0.89}$	0.539614	
SAAR	641	
SAAR$^{1.17}$	1923.198	
SOIL	0.45	
SOIL$^{2.17}$	0.176795	
Qbar	0.198154	m3/s

For sites less than 50 hectares, use 50 hectares and calculate rate per hectare and then muliply by actual size of site.
This is stipulated in the SUDS manual.

growth factors from FSH for south east are:

1 year =	0.87	0.172394	m3/s
30 year =	2.46	0.487458	m3/s
100 year =	3.19	0.63211	m3/s

Green field run-of rate for 1 hectare =	3.447874	l/s	1 year
	9.74916	l/s	30 year
	12.6422	l/s	100 year

Site area = 23 hectares so run-off equals:

	79.3011	l/s	1 year
	224.2307	l/s	30 year
	290.7707	l/s	100 year

Breadsell Lane, Hastings

Attenuation storage for discharge of 72 l/s Total impermeable area of 69000m^2

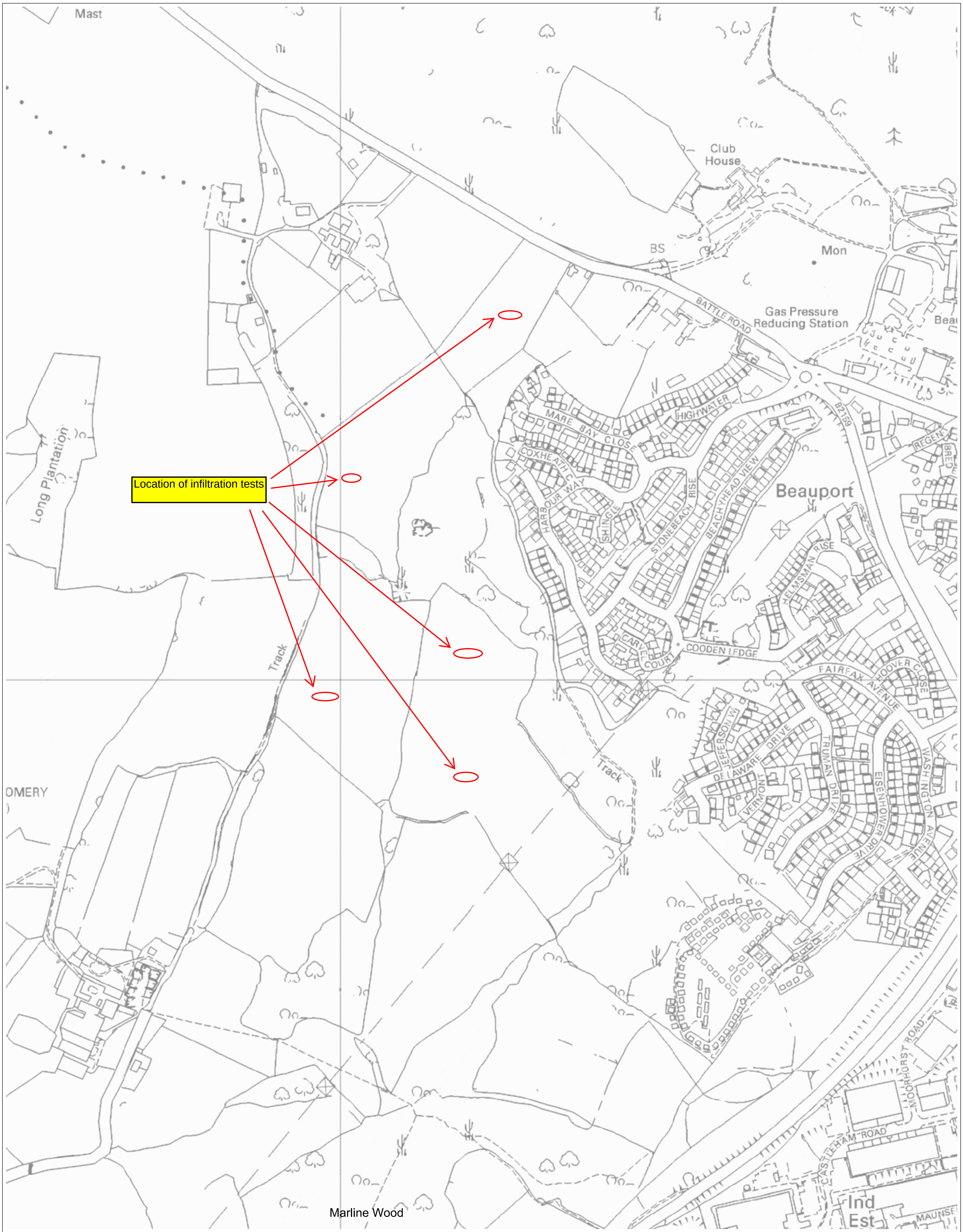
Time	Area	100yr rainfall	Discharge rate	storage required	100 +CC rainfall	Discharge rate	storage required
0.25	69000	31.30	72	2094.9	40.69	72	2742.81
0.5	69000	37.40	72	2451	48.62	72	3225.18
1	69000	44.60	72	2818.2	57.98	72	3741.42
2	69000	53.20	72	3152.4	69.16	72	4253.64
4	69000	63.20	72	3324	82.16	72	4632.24
6	69000	69.90	72	3267.9	90.87	72	4714.83
8	69000	75.10	72	3108.3	97.63	72	4662.87
10	69000	79.30	72	2879.7	103.09	72	4521.21
12	69000	83.00	72	2616.6	107.90	72	4334.7
24	69000	95.50	72	368.7	124.15	72	2345.55

Total site area is 23 hectares but impermeable area is likely to be limited to .
approximately 30% of the site area.

The ponds should therefore provide a minimum of 4750 cubic metres of storage.

Approximately 8000 cubic metres of storage will be provided upstream of the attenuation ponds as part of the SUDS systems. This will be made up of swales, soakaways and porous sub bases to the permeable paving.

Appendix C – Location of Infiltration Tests



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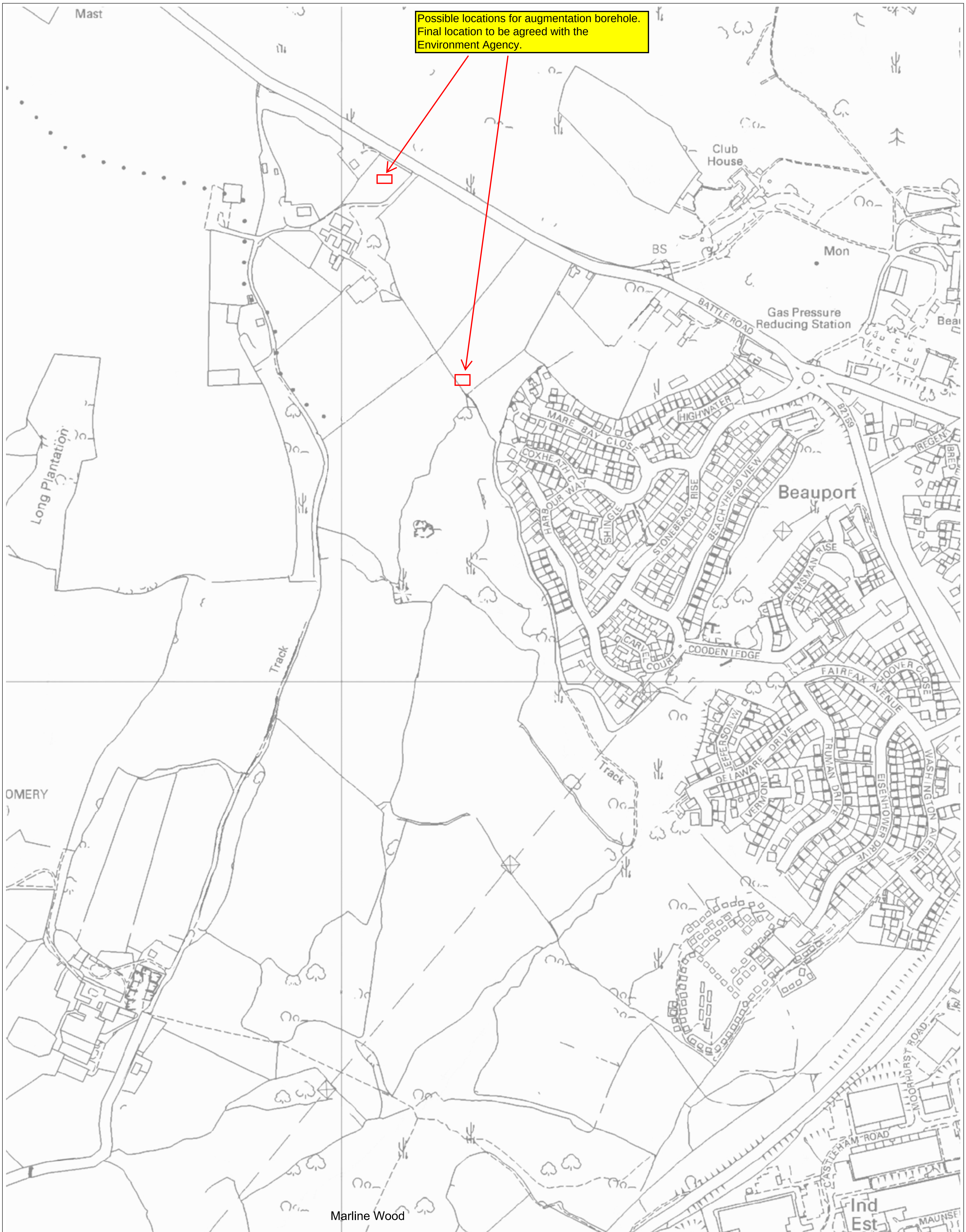
Rev.	

Appendix D – Location of Augmentation Borehole



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Appendix E – Typical SUDS Examples: Attenuation Pond, Swale, Reed Bed, Porous Paving

TYPICAL ATTENUATION POND

TYPICAL SWALE CONSTRUCTION

TYPICAL REED BED

TYPICAL POROUS PAVING CONSTRUCTION