Review of Hydrological Information for the Proposed Development at Breadsell Lane

by Premier Water Solutions Ltd

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This report has been prepared in response to Hastings's Borough Council (HBC) request for additional information regarding the use of Sustainable Urban Drainage Systems (SUDS). The preliminary hydrology report, prepared by HydroLogic Ltd, has also been reviewed and we would comment as follows:

Hydrological Monitoring (HydroLogic)

Baseline information for the catchment is very important and the recommendations put forward are appropriate for this size of development. The main emphasis at this stage is to assess the natural hydrological processes which operate in this area, with the primary focus on assessing the water balance particularly as it affects the Marline Woods SSSI. Site specific observation data from rainfall monitoring, water level analysis in the Ghyll Rivers, groundwater level monitoring and an indication of the evapo-transpiration rates will be required.

Drainage Philosophy (HydroLogic)

The main principles describing the proposed surface water drainage scheme have been identified in the previous report. The ground is not suitable for standard infiltration techniques such as soakaways, which are primarily used to recharge the underlying aquifer as close to the source as possible. Above and below ground ponds and tanks will be incorporated into the masterplan, with the attenuated discharge rates and pattern mimicking the existing Greenfield conditions.

Proposed Sustainable Urban Drainage System Philosophy

Natural England has raised concerns regarding the likely impact of the surface water runoff with particular reference to the Ghyll streams.

Planning Policy Statement 25 and The SUDS Manual C697, stipulates that new developments should be designed to ensure that the surface water run off post development is either equal to or less than the existing runoff into the downstream catchment. The principle is that development should have at least no impact or have a positive impact on the catchment and environment. Within this particular site there are various constraints such as the steep sided valley, the SSSI – Marline Valley Woods, the existing woodlands and public utilities.

The Ghyll streams are understood to be important in maintaining the habitat of the SSSI and it will be the main focus of the drainage systems to mimic the existing processes affecting the streams. The nature of urban hydrology means that as a result of an increase in impermeable area the rate and volume of surface water runoff will increase together with a decrease in response or lag time.

The main principle of SuDS is to control the surface water as close to the source as possible. In this respect it is proposed to retain the surface water runoff from small areas in a series of individual underground tanks in garages or under roads. The rainfall will be collected from the roofs and roads and be temporarily stored in the tanks, with an attenuated discharge rate say of 1 l/s. These attenuation systems would then be collected via a series of networks (above ground swales or

traditional underground pipework) before discharging into communal tanks/ponds for further attenuation. By attenuating the surface water at the top of the development, the rate of flow will also be reduced. Due to the steepness of the catchment unattenuated surface water will be fast flowing in pipework and swales and therefore the negative effects of erosion and scouring of the surface drainage infrastructure must be carefully considered.

A general overview of accepted systems which may be used within this development is shown below, but it must be emphasised that the actual systems developed by the final design will depend upon an assessment of site investigations, hydrological monitoring data and a detailed masterplan.

Rainwater recycling tanks: Rainwater is collected from the roof areas of both private and commercial premises, and stored in tanks for use in non-potable applications e.g. toilet flushing. Although this method technically removes rainfall from the hydrological cycle, it must still be accounted for elsewhere, and when the storage tanks are full, the overflow will generally contribute to surface runoff. Rainwater recycling systems tend to be more economical for commercial units and community facilities where there is a higher demand for non potable uses than in the home.

Individual attenuation tanks: Surface water runoff is stored in underground tanks formed from modular units and released at a rate of approximately 1 l/s into a subsurface collection system. In this particular case the geo-modular unit tanks ("milk crate" type units wrapped in an impermeable liner) will be located beneath the garages or driveways of houses and slowly release the surface water at a controlled rate.

Surface water from commercial and community areas will be stored in proportionally larger underground attenuation tanks but these are likely to be constructed using pre-cast concrete structures.

Permeable paving: For pedestrian, private road and driveway surfaces, it is proposed to make use of permeable paving, which may be in the form of block paviours or resin bound gravel finishes. The water falling on these surfaces is able to percolate through to the sub base below. The two types of permeable paving in common use either allow the water to infiltrate directly into the ground below or, using an impermeable liner so that the gravel sub base acts as temporary storage, allow the surface water to be collected via pipework and discharge into ponds or tanks for further attenuation. The type of paving will be determined following percolation tests and it is envisaged that a combination of the two may be used.

In some areas green roofs may be used. These are roofs specially constructed to allow vegetation to grow, and properly maintained; provide several benefits including some attenuation of rainfall runoff especially for lower intensity rainfall events, and enhancement to the natural surrounding habitat.

The attenuated surface water from the commercial and residential areas will be collected by a conduit system and further attenuated. The conduit system may be a typical below-ground pipework system or a combination of above ground swales and leats for example. These surface water networks would be sized for the peak capacity storm and as well as providing some intrinsic attenuation, would convey the flow of water to above ground ponds located in the open spaces within the development for further attenuation and water quality control.

Where the surface water is to be collected from the adopted estate roads, a full separate drainage system will be designed in accordance with the East Sussex County Council's requirements. These will either use a combination of large underground pre-cast concrete tanks or above ground ponds in public open spaces, attenuated to the Greenfield runoff rate and adopted and maintained by the council.

The size of the ponds will be determined by calculating the peak spill volume from the 1 in 100 year return period, 6 hour duration storm, with an additional 30% included to consider climate change. This is the industry recognised storm period which provides the worst case or maximum storage volume. The ponds will combine wildlife and conservation areas with a constant water level (with deep and shallow water areas) and dry detention basins, which will allow other uses during dry periods.

Water Quality

It is generally accepted that development will increase pollution risk to the environment. The main pollution source is ground contamination by hydrocarbons particularly from older cars leaking oil especially when parked or from stationary vehicles at busy junctions. Indeed, the introduction of vehicles into a previously vehicle-free area will raise contamination levels merely by exhaust emissions, even though these emissions are strictly controlled. Other pollutants are heavy metals, often from the deterioration of vehicles with age, and phosphates. Where there are potential pollution hot-spots e.g. in the 10,000sqm employment area, a separate surface water treatment system may be used. Oil interceptors may be installed at highway locations that may experience a high number of pollution incidents.

Hydrocarbons float on the surface of water and can cause severe pollution damaging plants and wildlife and affecting elements of the food chain; heavy metals in high concentrations are toxic to the aquatic environment with the potential of bio accumulation of the metals in the food chain. Concentrations of phosphates can lead to eutrophication of the natural waters.

Permeable paving has been tested and has been found to have extremely good pollution removal capabilities, particularly with the removal of heavy metals and hydrocarbons. Water quality improvement including sediment control may be addressed by the use of a multi-stage treatment train such that the surface water runoff will pass through permeable paving, initial attenuation tank, swales, and above ground ponds before discharging into the Ghyll stream. In addition the ponds as indicated on the edge of the development will be used as a final "polishing" and settlement of the water before discharging into the stream. For example heavy metals are thought to be attached to sediments and thus by effectively slowing the water flow through these ponds, the suspended solids will settle to the bottom of the pond. The vegetation will be carefully chosen to ensure that they can grow in sediments with a higher concentration of these contaminants. There are some species of plants that can effectively remove metals from sediments, and these can then be harvested and the metals reclaimed. It is also envisaged that providing reed beds in these ponds may reduce the pollutants that lead to eutrophication of the streams.

An overall operation and maintenance plan will be provided listing the responsibilities of all parties ranging from the individual home owner to the authorities. It is extremely desirable that a

management company be set up to ensure that the SuDS components are maintained appropriately throughout the lifespan of the development.

It is proposed to provide a “construction phase” surface water management plan, where suspended solids are likely to be a greater risk than post construction.