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OLDLANDS FARM PHASE 2 - DRAINAGE STRATEGY

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1. INTRODUCTION

Ramboll UK has been commissioned by Hanbury Properties Ltd to undertake a Drainage Strategy to facilitate Phase 2 Commercial Development at Oldlands Farm, Bognor Regis, West Sussex.

The site lies to the north-east of the approved Phase 1 commercial area and is bounded by the Bognor Northern Relief Road and the main Bognor Regis railway line. The commercial development area covers approximately 6.00ha of undeveloped agricultural farmland that has been subdivided into plots for 4no. Units (3no. B2 usage 1no. B8).

The purpose of this report is to confirm that a satisfactory strategy for the disposal of storm and foul water within the proposed commercial development is achievable.

2. SITE CONDITIONS

The Phase 2 commercial development is accessed through the Phase 1 development from the A29 Trunk Road and lies to the north east of the Phase 1 development area. The approximate National Grid Reference of the site is OSGB 101787N 494435E.



Figure 1 - Existing site layout

The topographical survey of the site shows the existing ground generally falling from the Bognor Northern Relief Road in a typically south easterly direction towards the field ditches and the Oldlands Farm Ditch. The existing site levels range from 2.32m AOD to approximately 0.33m AOD at the watercourse and ditches.

The site has been agriculturally farmed over several years. The natural drainage regime is for surface water to run directly off the surface clay soil and directly to the local ditches on the south west boundary. The Oldlands Farm Ditch flows in a north west to south easterly direction along the boundary of the site and forms part of the Internal Drainage Board system. Two small field ditch or drainage channels which take runoff from the existing fields run under the railway and discharge to the Lidsey Rife.

The Phase 2 development comprises of 4 separate plots and estate road with the following catchment areas:

Unit 1 (B2) = 7,490m²

Unit 2 (B2) = 6,495m²

Unit 3 (B8) = 20,700m²

Unit 4 (B2) = 4,505m²

Estate Roads = 4,500m² (1,100m² side road, 3,400m² main access)

The entire site is to be raised above the required 2.0m AOD flood level as part of the flood compensation works outlined within 'Flood Risk & Drainage Assessment' document within Appendix 1. The Drainage strategy for the Phase 2 development outlined in this report supersedes the strategy within the 'Flood Risk and Drainage Assessment' report.

3. STORM WATER MANAGEMENT DESIGN PHILOSOPHY

3.1 Proposed design

The proposed development has 4no. units of varying size from 1,042m² up to 10,610m² each unit includes service yard for deliveries, car parking facilities and associated hard standing infrastructure for pedestrian and vehicular access. Surface water will be generated because of replacing the existing farmland with an impermeable road construction.

It is proposed that collection of surface water run-off from external hard standing areas will be via permeable tanked pavement systems and traditional kerb and gully or linear channels within service yard or access points.

Roof drainage will be collected via standard rain water down pipes that will be connected into the surface water drainage networks.

Due to the large catchment areas, underground storage tanks will be required with an appropriate flow control device to hold back surface water flows to allow for gradual release back into the natural surface water regime at the Oldlands Farm ditch.

To attenuate flows within the access roads an oversized pipe network will be utilised prior to outfall to the ditch.

See Appendix 2 for Proposed Drainage Layout.

3.2 Catchment characteristics

The storm water runoff generated from the site will be managed using appropriate SUDS techniques up to the 1 in 100 year +40% storm event. This will ensure that the peak rate of storm water leaving the developed site is controlled and accounted for in the design.

As the intention is to discharge to a watercourse, the requirement specified is for the proposed peak storm water runoff rate (1 in 100 year, 6 hour rainfall event) and runoff volume not to exceed pre-development rates (DEFRA, 2015). The Greenfield runoff rate has been calculated using the Interim Code of Practice for Sustainable Drainage Systems (ICP SUDS) methodology using Micro Drainage software (Micro Drainage Limited., 2017). The input variables for the ICP SUDS methodology are the same as for the Institute of Hydrology Report 124 (IH124) method. Results are summarised below, full details are within Appendix 3.

ICP SUDS mean annual flood flow rate equation:

$$Q_{BAR_{RURAL}} = 0.00108 \times AREA_{0.89} \times SAAR_{1.17} \times SOIL_{2.17}$$

Unit No.	Q _{bar} (l/s)
Unit 1	2.7
Unit 2	2.4
Unit 3	7.5
Unit 4	1.6
Estate Roads	1.6

Based on the above, the runoff limitation should be based on a maximum discharge of Q_{bar} of 1.6 to 7.5l/s. The aspiration for the discharge of surface water runoff to be limited to Greenfield equivalent rates from the site provides a very onerous flow restriction, however, and would result in an elevated risk of blockage to a flow restriction device, increasing the maintenance burden. As such, Environment Agency (EA) guidance (Kellagher, 2013) stating a minimum value of **5.0l/s** for flow devices will be adopted in this design.

To achieve flow rate above 5.0l/s minimum outflow rate it is proposed to split the Phase 2 site into 2no. surface water drainage networks as follows:

Network 1

Unit 1 + Unit 2 + Estate Side Road. Q_{bar} = 2.7 + 2.4 + 0.4 = 5.5l/s

Network 2

Unit 3 + Unit 4. + Estate Main Access. Q_{bar} = 7.5 + 1.6 + 1.2 = 10.3l/s

3.3 Output summary

It is intended that flows will be restricted by a combination of orifices and ultimately vortex flow control units at the final discharge points in both drainage networks.

Both networks have been designed to contain water below ground to prevent flooding of the plots across the range of storm durations. This will be achieved through a combination of storage within attenuation tanks and permeable paving subbase.

Table 1 below sets out the contributing catchment summary for both networks which is taken as the impermeable surface only: carriageway, footway, building footprint, car parks and service yards.

Table 1 – Drainage network summary

Network Reference	Catchment Area (ha)	Outfall Discharge Limit (l/s)			Estimated Required Storage Volume (m ³)
			Proposed Flow Restriction	Proposed Peak Discharge (l/s)	
1	1.51	5.5	Vortex	5.5	1,500
2	2.86	10.3	Vortex	10.3	2,900
Total	4.37	15.8			

Due to the low-lying area and adjacent flood plain, all surface water outfalls discharging below the 2.0m AOD flood level will utilise non-return valves on the outfall pipes to prevent backflow from the watercourse into the drainage network. A freeboard above ditch invert level is to be provided where falls allow whilst maintaining minimum cover depths to pipework.

3.4 Outfall flow restricting device – Vortex flow control

The flow control at the outflow locations will be controlled using a vortex flow control device. This device is self-activated and delivers effective flow control to mitigate against adverse downstream affects. Under low flow conditions, the flow control behaves like an oversized orifice. As the water depth increases, a vortex begins to form within the unit which creates a back pressure and chokes the flow through the aperture restricting the flow during higher flow conditions.

The device will require periodic inspection and maintenance to ensure any build-up of blockage material is removed but has a lower risk of blockage than a traditional orifice.

3.5 Pollution control

The car parks and services yards are considered as moderate risk in regard to fuel spillages and therefore oil/petrol interceptors will be employed prior to outfall to the natural watercourse. This will be in the form of a Class 1 Full Retention Separator.

4. FOUL WATER MANAGEMENT DESIGN PHILOSOPHY

The foul water discharge from each unit will be managed via standard gravity fed systems. Each network will culminate at a centralised private foul pumping station serving the Phase 2 site. This will discharge into the Enabling Works foul drainage network and ultimately to the existing foul network installed as part of the Phase 1 development.

The existing foul system drains via gravity within the access road to a public pumping station located at the entrance to the Oldlands Farm Estate adjacent to the A259, A29 roundabout. Acceptance of foul flows is subject to agreement with the sewer authority who have adopted the pumping station.

5. MAINTENANCE STRATEGY

A key consideration of the drainage design is to ensure a minimum requirement level for maintenance to minimise the risk of the system failing and the cost and disruption associated with rectifying any issues caused by defects. The main issues associated with maintenance of drainage systems are sedimentation, root ingress and associated blockage of pipes, manholes and SUDS features.

The design incorporates measures to mitigate these issues through the use of sumps and trapped gullies to reduce sediment flows through the system. The correct installation of the specified pipe surround material will mitigate the risk of root infiltration into the underground drainage. Whilst these measures will reduce the risk of a reduction in performance, the access road drainage systems across will nevertheless require regular maintenance which should be incorporated within the maintenance regime for the development as a whole.

The table below provides details of the recommended maintenance measures for the access road drainage system:

Table 2 – Maintenance summary: Drainage pipes

Maintenance schedule	Required Action	Frequency
Regular Maintenance	Remove sediment and debris from inspection chambers and flow control chambers	Annually
	Cleaning of any filters and swales as below	Annually
	Remove any root ingress	As required
Occasional Maintenance	CCTV survey of drains to check alignment, cracking and joint displacement	10 year intervals
Remedial Actions	Jetting of drains	5 year intervals or as required
	Reconstruct cracked pipes or lengths of pipework with joint displacement	As required
	Filter drains - replacement of clogged geotextile	10 years or as required
	Replace damaged gully and inspection chamber covers	As required
Monitoring	Inspect silt traps and note rate of sedimentation accumulation	Monthly in the first year and then annually.
	Check gullies and remove silt or debris	Quarterly and after leaf fall

6. SUMMARY

Existing surface water runoff from farmland discharges to a number of receiving ditches. Surface water runoff from the new development will be discharged into the existing ditch network via a carrier pipe drainage system located within the carriageways and beneath the proposed hard standing areas.

In order to attenuate surface water discharge to the watercourses in order to mitigate downstream affects, flows will be restricted to greenfield run-off rates (Network 1, 6.7l/s, Network 2, 9.1l/s) by use of vortex flow control device located at the final manhole preceding each outfall position. Attenuation storage has been incorporated into the carrier pipe design as online storage.

The two drainage networks have been designed to prevent surface flooding for rainfall events up to the 1 in 100 year storm + climate change (applied as a 40% uplift in peak rainfall intensity).

Foul water will be drained via gravity connecting to centralised private pumping station. This will then discharge to the Enabling Works foul network and ultimately the public pumping station located at the entrance to the Oldlands Farm site.

7. WORKS CITED

- DEFRA. (2015). *Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems*. London: Department for Environment, Food and Rural Affairs.
- Kellagher, R. (2013). *Rainfall Runoff Management for Developments - Report SC030219*. Bristol: Environment Agency.
- Micro Drainage Limited. (2017). *Micro Drainage*. UK: XP Solutions.

APPENDIX 1

FLOOD RISK AND DRAINAGE ASSESSMENT

APPENDIX 2

PROPOSED SURFACE WATER DRAINAGE LAYOUT

APPENDIX 3

GREENFIELD RUNOFF CALCULATIONS