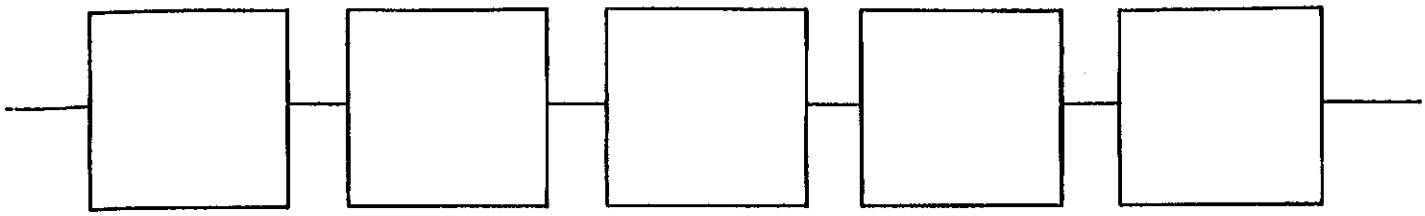

Project No: CG/1990 *Doc.Ref: CG/1990/DrainageReport* *Rev:*

Upper Farm, Rhoose

Drainage Report

WDA

May 2006

Contents

Introduction

As part of the proposed Planning Application for the residential development of the site it will be necessary to submit outline details of the drainage strategy for both the foul and surface water disposal from the site.

The proposals indicated above will be included within the development brief in order to demonstrate to the local authority a comprehensive approach to the provision of a sustainable infrastructure.

Site Description

The site is located immediately east of the settlement of Rhoose and is bounded to the north by the B4265, Porthkerry Road; to the east by the new highway link to Rhoose Point and to the south by the Vale of Glamorgan railway line.

The site contours dip generally from north to south (+60 m to +41 m AOD) with localised low spots adjacent to the railway line.

Searches conducted with the Statutory Undertakers indicate that a medium pressure gas main and a foul rising main transverse the site from a west to an easterly direction immediately parallel to the railway line. The locations of these services are as shown on the Undertakers drawings included within the Appendix to this report.

From a visual inspection and discussions with the Land Drainage Officer and Network Rail it has been established that 3 no. culverts are present underneath the railway line and these allow surface water run-off to drain from the site, underneath the railway line, to the south (see attached plan).

At the northern part of the site, adjacent to Dams Lane, a highway drain discharges into an open ditch. This drain collects surface water run-off from the B4265.

At the eastern end of the site above ground drain passes underneath the new Rhoose Point link road which allows surface water run-off from the fields immediately to the east to discharge on to the development site.

Site Geology

A brief overview has been undertaken of the site geology based upon existing published information and knowledge of the local area. It is understood that a geotechnical investigation of the development site has been carried out but the information has not been made available for the purposes of this report.

Therefore, the following overview should be verified by comparison with the existing geotechnical investigation and or a more detailed site investigation.

Superficial Deposits

The geological plan covering the area (ref 1) indicates the site is covered with a thin clay soil. Although the actual nature of the soil is not described in the memoir, it is likely to be a residual soil, formed by the physical and chemical weathering of the bedrock. Such a clayey soil is common in the Vale of Glamorgan area. Although the permeability of the material has not been determined it is likely to be of low permeability. Carter and Bentley (ref 3) indicate a range of coefficient of permeability for clay as 1×10^{-8} m/s to 1×10^{-11} m/s. This will need to be confirmed by a site investigation.

Solid Geology

The Porthkerry Formation is of Lower Jurassic age and outcrops across a large area of the Vale of Glamorgan. It is known to comprise up to 120 m of interbedded blue grey muddy fine limestone and blue grey calcareous shaley mudstones. Bed thicknesses are described as thinly to thickly bedded. A description of the geology on the geological plan (ref 1), along a cliff section to the southeast of the site, indicates that the limestone beds generally vary in thickness from 0.05 m to 0.5 m. Locally thicker limestones were noted as being present up to 1.2 m thick.

Structural Geology

The Porthkerry Formation in the vicinity of the site (ref 1) dips generally southwards from 7° to 10°. It is inferred from the geological map that a series of north west – south east trending normal faults cross the land to the south of the site. These are noted in the cliff section to the south of the site and may possibly pass beneath the site. They are inferred as being present to the south of the railway line. The downthrown on these faults is to the northeast and is not likely to be more than a few metres. Well-defined joints are present within the Porthkerry Formation and are noted on the geological plan in the vicinity of the site. Jointing appears to be orientated in two sets, one trending northwest – southeast and another north northeast – south southwest.

Hydrogeology

The geological memoir covering the area (ref 2) states that the rocks of the Lower Lias (Lower Jurassic) are a multi-layered aquifer. This means that each well jointed bed of limestone acts as an aquifer but these are interbedded with mudstones that act as an aquiclude, with very little water passing through them.

Records in the area indicate that yields from 100 mm diameter boreholes are typically less than 0.5 1/sec. One borehole at Rhoose cement works, 305 mm in diameter and 122 m deep into the Lower Lias yielded 14.11 1/sec (ref 2).

Water infiltration into the bedrock beneath the site is likely to be influenced by the joints present in the limestone, the north west – south east trending faults and the mudstones present within the Porthkerry Formation.

Water infiltrating into the soil and rock too the north of the site is likely to flow through the soil and rock in a southerly direction, as the land drops off seaward and the rocks also dip towards the south. Where preferential pathways are blocked in the rock, springs are possible. Although not indicated on the Ordnance Survey plan covering the proposed site, springs are indicated as being present in the surrounding area.

Foul Water Drainage

In December 2005 on the instructions of the Welsh Development Agency, Welsh Water undertook, via their Network Agents, Montgomery Watson, an Hydraulic Impact Assessment of the existing and proposed foul water drainage systems in order to identify the level of capacity and suitable point of connection.

The completed report is attached to the Appendix and is reproduced in full and a brief synopsis of the conclusions is as follows.

Four options were considered using base flows for 600 units together with the existing flows in the surrounding network.

The preferred option is that of constructing a new pumping station adjacent to the existing rising main at the mid southern part of the site, divert the existing flows from the Rhoose Pumping Station into the new facility via additional storage and connecting the new facility into the upstream part of the rising main which will pump the flows to the Porthkerry Pumping Station.

Using this option all necessary works can be undertaken within the existing development site and it also affords the opportunity for Welsh Water to decommission the two smaller pumping stations at Murlande Way to the north of the site and to connect these via a gravity system into the proposed development.

Welsh Water have acknowledged that in times of severe flows the existing pumping station at Rhoose, Station Road and Porthkerry are liable to spill to bathing waters although these are at intervals of less than 3 spills per bathing season.

The removal of approximately 4.1 L/sec of flow to Rhoose Pumping Station via the new gravity connections to Murlande Way will obviously be of benefit to Welsh Water in helping to reduce spill incidents.

In a similar vein, by increasing the storage capacity at the new development and correct flow rates applied to the new pumps, a more regulated flow will be experienced at Porthkerry Pumping Station, again, helping to reduce spill incidents.

As for Station Road, the extra capacity provided at Rhoose may allow for higher flow rates to be introduced with the beneficial effect of spill reduction at this pumping station.

Initial enquiries with Welsh Water have confirmed that a new pumping station and associated infrastructure can be requisitioned under sections 98 to 101 of the Water Industry Act 1991.

Surface Water Drainage

Three options have been investigated for the disposal of the surface water drainage from the proposed development.

The first option would be to use the drainage connections that currently exist beneath the railway line by limiting the flow rates to green field run-off via a combination of on site storage and flow controls.

Whilst in practical terms this can be achieved there appears to be some doubt with regard to the ability of the drainage systems south of the railway line to be able to cope with the existing flows.

Due to the lack of clarity in this respect it is felt that this option may not meet with the approval of the Local Authority and could be challenged via third parties.

The second option would be to connect to the existing adopted storm sewer that passes under the level crossing at the end of Station Road/Torbay Terrace.

This option would require an element of on site storage together with a flow control mechanism.

An examination of the Welsh Water infrastructure plans shows that the adopted sewer consists of a length of 375mm pipe connected to a 600mm pipe which then connects to a 900mm pipe that runs under the level crossing before discharging to an open watercourse. A copy of the records is included within the Appendix.

However, a detailed CCTV survey of this system indicates that the pipework consists mainly of 600mm diameter with a short length of 900mm diameter and the final outfall being of 750mm diameter. A copy of the full report is included within the Appendix.

Using the above evidence and from analysis of the catchment area of the site we would need to provide some approximately 2,300 cubic metres of on-site storage and a 900mm diameter outfall pipe connected to the adopted sewer. A detailed plan showing the layout of this system is included within the Appendix.

It should be noted that the construction of the outfall pipe along Torbay Terrace would be of the order of 300m in length, approximately 3m in depth to the invert and may require the diversion of a number of Statutory Undertakers Services.

Welsh Water have indicated that such a system could be requisitioned under sections 98 to 101 of the Water Industry Act 1991, which would include for the adoption of the on-line storage tank.

The third option would be to provide a completely new outfall to the east of the site via a thrust bore under the railway line and across to a new or existing sea outfall. A detailed plan showing the layout is included within the Appendix.

This layout will require a 1000mm diameter storm sewer to be installed via thrust bore or mini tunnelling methods at a depth of approximately 4m below existing ground level. The level of the running track at this location is approximately +3m above existing ground level.

Discussions with specialist sub contractors have confirmed that a 3m diameter thrust pit will be required to the south of the railway line with a similar pit or shaft on the northern side which is termed the reception shaft.

Detailed ground investigations consisting of a minimum of 2no. rotary cored boreholes, and a 4.5m deep mechanically excavated rock pit will be required prior to detailed design to confirm the underlying strata at this location.

In order to reduce the depth of the thrust and reception pits it is advised that the layers of overburden are reduced via mechanical excavations with the surplus material processed and reused on site.

With regard to the installation of infrastructure below Network Rail Assets, permission will be required and technical approvals sought from Network Rail. However, preliminary discussions have indicated that subject to the necessary information being provided technical approval should be forthcoming. We are currently awaiting written confirmation of the above from Network Rail.

In addition to the above there may also be a need to obtain a FEPA licence for the construction of the storm water outfall structure as well as permission to discharge to sea. A flow chart indicating the consultations required and processes involved is included in the Appendix.

Welsh Water have indicated that such a system could be requisitioned under sections 98 to 101 of the Water Industry Act 1991.

Conclusions and Recommendations

Foul Water Drainage

Of the four options explored by Montgomery Watson it is clear that Option 4, a new pumping station constructed on the development site, would provide the most benefit to the existing infrastructure and would be the least disruptive to construct in terms of installation and connections to the existing system.

The pumping station should be designed in accordance with Welsh Water Guidelines in order that it can be offered for adoption or, if so desired, requisitioned from Welsh Water.

Storm Water Drainage

Three options have been considered which are:- provide storage on site and discharge at green field run-off rates to the existing culverts under the railway line; discharge to the western part of the site via provision of storage on site, attenuation of flows and connection to the public system upstream of the level crossing; discharge to the east via a new system under the railway line direct to a sea outfall or outfall structure.

Due to the uncertainty of the capacity of the existing infrastructure south of the railway line and the possibility that the storage tanks would not be adopted as they are not connected to a public system it is not recommended that option 1 is considered.

Similarly, option 2 should be discounted, discharge to the west, for the following reasons. The installation of a new 900mm diameter sewer along Torbay Terrace will cause major disruption to the residents of this street and will require the alteration, protection and temporary diversion of a number of statutory undertakers plant for the majority of its length.

Whilst Welsh Water would be willing to adopt a storage tank that provides storage for a 30 year return period, the design of the system as shown is to a more stringent 100 year return period. Thus giving a more robust case. The outcome of this is that any return period storage over and above the 30 year requirements would not be adopted by Welsh Water and would have to remain in private ownership thus giving rise to long term maintenance issues.

It is clear therefore that option 3, that of a new system discharging to the east, would provide for a comprehensive drainage solution that would not appear to have any consequential effect on the surrounding environs and subject to the necessary permissions and approvals, could be offered for adoption or requisitioned from Welsh Water.

References

1. British Geological Survey Sheet ST 06 NE 1:10,000 Scale

2. Wilson D et al. Geology of the South Wales Coalfield. Part IV, the Country around Bridgend, 1990. British Geological Survey.

3. Carter M, and Bentley, S.P. Correlations of Soil Properties. 1991. Pentech Press