Flood Consequence Assessment and Drainage Strategy

Swanbridge Road, Sully (Phase 2)

Taylor Wimpey

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1 INTRODUCTION

Authorisation

1.1 On the instruction of Taylor Wimpey, a Flood Consequence Assessment (FCA) has been carried out by Vectos in order to support an outline planning application for the development of the southern (Phase 2) land at Swanbridge Road, Sully. The FCA includes an assessment on the alteration of the surface water runoff regime, and the mitigation measures to manages these to acceptable levels outlined in a conceptual strategy.

Background

1.2 The overall site (i.e. Phase 1 and Phase 2) consist of two undeveloped agricultural fields. The existing residential area of Sully is located to the west and with Swanbridge Road to the east. The overall site has been separated into a northern (Phase 1) and southern (Phase 2) land area. The residential development of Phase 1 is the subject of a separate and earlier planning application that has recently been approved (2013/01279/OUT). This FCA relates to the residential development of Phase 2.

1.3 Phase 2 has an area of 6.72ha and the proposed development introduces up to 190 residential dwellings together with the associated road infrastructure and public open space. In accordance with the guidelines on Development and Flood Risk, as set out in Planning Policy Wales Technical Advice Note 15 (TAN15), this FCA has been prepared to assess the consequences of flooding at the site and identify flood mitigation measures, where required.

1.4 The site is located in Zone A of the Development Advice Maps (DAMs). This is classified as the zone that is considered to be at little or no risk of fluvial or coastal/tidal flooding. With respect to the other potential sources of flood risk, the National Resource Wales maps do not reveal there to be any significant issues that may result in developmental constraints.

1.5 In accordance with TAN15 and the local planning policy on flood risk and surface water drainage, the proposed development must also result in no detrimental impact off site in terms of surface water runoff from the development. Evidence of the proposed surface water management strategy is therefore also an essential element of this FCA.

Aims and Objectives

1.6 The aim of this FCA is to understand the consequence of flooding to the proposed development and show that the site can be developed safely, without adversely affecting the risk of flooding at the site and also to surrounding areas.

1.7 The objectives of this FCA are therefore to:

- Confirm the local sources of flooding that may be present;
- Undertake an appraisal of the flood consequences to the proposed use of the site and potential impact of the development on flood risk elsewhere; and
- Provide a conceptual strategy for mitigating flood risks to or resulting from the proposed development of the site with respect to surface water runoff. This will be based on the principles of Sustainable Drainage Systems (SuDS).

Development Proposals

1.8 The developable area upon which permission is sought for up to 190 residential dwellings together with the associated road infrastructure and public open space within Phase 2. The development of Phase 1 to the north was also residential-led.

Limitations

1.9 The general limitations of this assessment are that:

- A number of sources have been used to compile this document, whilst Vectos believe them to be trustworthy; Vectos is unable to guarantee the accuracy of the information that has been provided by others.
- This report is based on information available at the time of preparation. Consequently, there is potential for further information to become available. These changes may lead to future alteration to the conclusions drawn in this report for which Vectos cannot be held responsible.

2 SITE DESCRIPTION

2.1 The overall site is located on the north-east edge of the urban area of Sully, as shown in Appendix A. There is an existing residential development along the western site boundary and with Swanbridge Road along the eastern site boundary, beyond which is located agricultural land. The overall site has been separated into a northern (Phase 1) and southern (Phase 2) area – the latter of which is the subject of this FCA.

2.2 Phase 1 is to the north, and consists of three separate fields. This was subject of a separate and earlier planning application (2013/01279/OUT) that has recently been approved.

2.3 Phase 2 is made of up a single field. However, it is only part of this field that is proposed for development. The remainder of the field slopes to the south, which extends to an existing residential development, approximately 250m to the south of Phase 2.

Site Topography

2.4 The overall site straddles a topographical ridge, which runs from east-west. The area to the north of this ridge (predominantly within Phase 1) drains to the north-east, towards Cog Road (which is adjacent to the northern boundary of Phase 1).

2.5 A contour plan generated from the topographic survey of the site is included in Appendix B. Maximum ground levels within Phase 2 are approximately 46m AOD, adjacent to the eastern boundary. Ground levels over a small part of Phase 2 fall northwards (into Phase 1), but the majority falls to the south-west (across Phase 2). Ground levels are lowest adjacent to the western and southern boundary – in particular the south-west corner, where levels are approximately 34m AOD.

2.6 All built development proposed as part of Phase 2 is located to the south of this ridge, which falls in a south-west direction towards a drainage ditch that is located on the site boundary.

Hydrology

2.7 The closest watercourse of note is the Sully Brook, which is located approximately 1km to the north of the site. The watercourse is elevated at only approximately 10m AOD and presents no flood risk to the site. Sully Brook joins the Cadoxton River to the south-west of the site, with this then flowing into the sea.

2.8 A described above, a drainage ditch is located adjacent to the south-west boundary of Phase 2. Whilst this has not as yet been confirmed by DCWW, the drainage ditch appears to discharge into a public surface water sewer serving the adjacent residential development – as indicated in Appendix C. Ground levels suggest that rainfall that fails to infiltrate into the ground, will be collected by this drainage ditch.

Geology and Hydrogeology

2.9 The British Geological Survey (BGS) online 1:50,000 scale bedrock geology mapping suggests that the site is underlain by Mercia Mudstone group, which is characterised by a sequence of brown and red-brown, calcareous clays and mudstones, with occasional beds of impersistent green siltstone and fine-grained sandstone. This classification of geology would normally result in a limited potential for infiltration in the surface water drainage strategy for the site.

2.10 The Cranfield University soilscapes online tool identifies the soils to be freely draining slightly acid but base-rich soils. This has been somewhat verified through anecdotal evidence.

2.11 A desk based study has not been conclusive with respect to the practicality of infiltration on site. Unfortunately, access to the site for infiltration testing was not possible prior to the production of this FCA – hence it has not been possible to prove whether infiltration is viable. As a conservative measure, it has been assumed that limited infiltration will be achievable, similar to the approach that was taken in the strategy with the Phase 1 planning submission.

Drainage Infrastructure

Surface Water

2.12 The DCWW drainage records are included in Appendix C. There are no public surface water sewers that cross the site. There are public surface water sewers located to the west of the site, within the existing residential area.

2.13 In addition to the public surface water sewers, there is evidence of a network of drainage ditches that also help convey surface water. Whilst there has been no tracing completed, it is considered likely that these drainage ditches either convey water into the DCWW public sewer, into the road drainage or into Sully Brook. There is a drainage ditch to the north-east of the overall site, heading east along Cog Road. There is also a drainage ditch to the south-

east of the overall site, heading south along Swanbridge Road. These ditches appear to drain the highway as well as the runoff from the surrounding greenfield and developed areas.

2.14 Most importantly for Phase 2, there is a drainage ditch located adjacent to the south-west corner of the site. This ditch appears to discharge into the adjacent public surface water sewer and therefore indicates that runoff from the site is drained to via a public surface water sewer.

Foul Water

2.15 The DCWW drainage records and correspondence are included in Appendix C. There are two public foul rising mains sewers that cross into the south-east corner of the site. DCWW were contacted to confirm details about this feature, including the easement and advised that they have limited information about the rising main. The depth of the rising main is unknown and it was stated that this would need to be established on site. DCWW have confirmed that any easements associated with the feature will be confirmed once planning has been submitted.

2.16 An easement of 3m either side of the rising main will be offered to DCWW. However, for the purposes of the illustrative masterplan, a 6m easement either side has been incorporated.

2.17 There is a public foul sewer to the north of the site, along Cog Road, and another to the east of the site, along Swanbridge Road – with these connecting at the junction of the roads. DCWW advised that these sewers require a 6m easement (i.e. 3m either side of the sewer).

2.18 Based on the information from DCWW, it is understood that foul water from this infrastructure is treated at their Waste Water Treatment Works before being discharged to Sully Brook.

3 ASSESSMENT OF FLOOD RISK

National Planning Policy

3.1 Technical Advice Note 15 (TAN15) on Development and Flood Risk provides technical guidance to supplement the policy set that is out in Planning Policy Wales (PPW) in relation to development and flooding. It provides a framework within which risks arising from both river and coastal flooding, and from additional run-off from development in any location, can be assessed and the consequences to a proposed development then considered.

3.2 Managing flooding is an important part of contributing towards achieving sustainable development. Paragraph 2.11 of TAN15 advises that the relevant sustainable development considerations from the perspective of flooding include:

- Guiding development to locations at little or no risk from river, tidal or coastal flooding or from run off arising from development in any location;
- Bearing in mind that government resources for flood and coastal defence are directed at reducing risks for existing development and are not available to provide defences in anticipation of future development;
- Managing the consequences of flooding where development can be justified and the consequences are considered acceptable;
- Making provision for future changes in flood risk, for example taking account of climate change where they can be anticipated;
- Bearing in mind measures within Catchment Flood Management Plans or Shoreline Management Plans to restore substantial functionality and/or natural heritage benefits of floodplains through the removal of inappropriate existing built development.

3.3 The planning authority will need to be satisfied that a proposal is justified and that the consequences of flooding are acceptable. Where the risks and consequences of flooding cannot be managed to an acceptable level, then developing in these areas shall be avoided.

Development Advice Maps

3.4 Under the guidance in TAN15, Development Advice Maps (DAMs) are used to determine whether the consequences of a particular frequency of flooding event are acceptable for the location of a specific type of development or land use.

3.5 There are three DAM Flood Zones (A, B and C) to which are attributed different planning actions, as summarised in the extract of Figure 1 from TAN15 on the following page.

Description of Zone		Use within the precautionary framework
Considered to be at little or no risk of fluvial or tidal/coastal flooding.	A	Used to indicate that justification test is not applicable and no need to consider flood risk further.
Areas known to have been flooded in the past evidenced by sedimentary deposits.	B	Used as part of a precautionary approach to indicate where site levels should be checked against the extreme (0.1%) flood level. If site levels are greater than the flood levels used to define adjacent extreme flood outline there is no need to consider flood risk further.
Based on Environment Agency extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal)	C	Used to indicate that flooding issues should be considered as an integral part of decision making by the application of the justification test including assessment of consequences.
Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.	C1	Used to indicate that development can take place subject to application of justification test, including acceptability of consequences.
Areas of the floodplain without significant flood defence infrastructure.	C2	Used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered.

Figure 1 from TAN15 on the composition and use of different zones

3.6 The extents of these DAM Flood Zones are based on the best available information that is considered sufficient to determine when flood risk issues need to be taken into account with development.

3.7 The site is located entirely in DAM Zone A, which is considered to be at little or no risk of fluvial or coastal/tidal flooding. According to TAN15, this provides sufficient evidence that the Justification Test (as defined in Section 6 of TAN15) is not applicable and that there is no further need to consider flood risk from fluvial or coastal/tidal sources.

Other Flood Sources

3.8 Whilst the requirement to consider other sources of flood risk is not outlined in TAN15, this has become an important part of an adequate FCA. This is partly a result of the availability of information from NRW – as considered below.

Natural Resources Wales

3.9 Natural Resources Wales (NRW) provided advice to inform the works that were completed for Phase 1. NRW were re-contacted for their requirements for Phase 2, with this correspondence included in Appendix D. NRW advised of the following requirements for Phase 2:

> *"Surface water run-off should be dealt with by way of a Sustainable Drainage System (SUDS), as required in Section 8.5 of TAN15, in order to attenuate flows and prevent an increased risk of flooding in the catchment. If good reason can be given why SUDS cannot be implemented, then any conventional drainage system installed should also provide attenuation. If a conventional system is installed, then this should demonstrate an improvement on the status quo prior to discharge to a watercourse.*
>
> *A Surface Water assessment should be undertaken by the developer at a pre planning /outline planning stage which should include the design of the surface water drainage system and how it will affect the site layout.*
>
> *At this stage the applicant should produce the following information:*
>
> - *Demonstrate how the principles of Sustainable Drainage Systems have been applied to the development identifying what techniques will be used.*
> - *Set aside land specifically for SUDS.*
> - *Estimate the discharge rate for the site. Greenfield discharge rates should be sought on Greenfield sites, and also on Brownfield sites (where possible).*
> - *Estimate the volume of 1 in 100-year attenuation to be provided and what techniques will be used to provide the attenuation.*
> - *Take into account TAN 15 climate change requirements.*
>
> *Regarding the Surface Water Assessment, the above are issues that should be considered at the pre planning/outline planning stage, more detail will be required when a full*

planning application is received. It is important that a drainage design strategy should be carried out at the outset to identify the options for the design of the surface water drainage system and how it will affect the site layout."

3.10 This guidance has been used to inform the assessment of flooding in Section 4, notably the concepts and approach of the surface water drainage strategy that is outlined in Section 5.

Local Planning Policy

3.11 The Vale of Glamorgan Deposit Local Development Plan 2011-2026 has been prepared and is based on the information gathered at previous stages of the LDP process.

3.12 The Plan sets out the vision, objectives, strategy and policies for managing development in the Vale of Glamorgan, and contains a number of local planning policies and makes provision for the use of land for the purposes of housing, employment, retailing, recreation, transport, tourism, minerals, waste, and community uses.

3.13 It also seeks to identify the infrastructure that will be required to meet the growth anticipated in the Vale of Glamorgan up to 2026, and provides a monitoring framework for assessing the effectiveness of the Plan.

3.14 The relevant policies in the Plan are summarised below:

- Policy MD1 Location of New Development – which advises that new development will be favoured where it provides a positive context for the management of the water environment by minimising or avoiding areas of flood risk;
- Policy MD4 Community Infrastructure and Planning Obligations – which advises that community infrastructure may include the provision of improvement of environmental protection and enhancement such as flood protection; and
- Policy MD8 Environmental Protection – which advises that development proposals will be required to demonstrate they will not result in an unacceptable impact on people, residential amenity, property and/or the natural environment from such things as pollution of land, surface water, ground water and the air; and flood risk and consequences. It goes on to advise that where impacts are identified, that it will be necessary to demonstrate that appropriate measures can be taken to minimise the identified impact to an acceptable level.

Lead Local Flood Authority

3.15 In accordance with Flood Risk Regulations 2009 and the Flood and Water Management Act 2010, the Vale of Glamorgan Council as Lead Local Flood Authority (LLFA) will prepare plans to identify the flood risk areas within its administrative area. It will work alongside other flood risk agencies to ensure that its flood risk management activities are in line with the Welsh Government's National Flood and Coastal Erosion Risk Management Strategy.

3.16 The Flood and Water Management Act 2010 places a responsibility upon the Vale of Glamorgan Council, as LLFA, to develop, maintain, apply and monitor a strategy for local flood risk management (a 'Local Strategy'). In the development of a Local Strategy, the LLFA will balance the needs of communities, the economy and the environment.

3.17 The Local Strategy will only deal with local flood risk which is defined in the Act as being a flood risk from, surface runoff; groundwater and ordinary watercourses. Flood risk from Main Rivers and the sea is overseen by Natural Resources Wales whereas flood risk from public sewers is the responsibility of Dŵr Cymru Welsh Water (DCWW) – but the Vale of Glamorgan Council will work with these bodies to enable a coordinated approach).

3.18 The Local Strategy considers the potential effects on flood risk and the environment posed by development, existing infrastructure, maintenance procedures and how the risks can be best managed.

3.19 The draft local flood risk management strategy (October 2012) defines the national and local objectives and measures for managing flood risk, and defines what measures will be used to deliver local objectives, who will be responsible for implementing the measures and how the measures will be funded.

Sustainable Drainage Systems Standards for Wales

3.20 The Sustainable Drainage Systems Standards for Wales identifies a drainage hierarchy which aims to ensure that runoff is treated as a resources and managed in a way that minimised negative impacts of the development on flood risk, the morphology and water quality of receiving waters and associated ecology.

4 FLOOD CONSEQUENCES

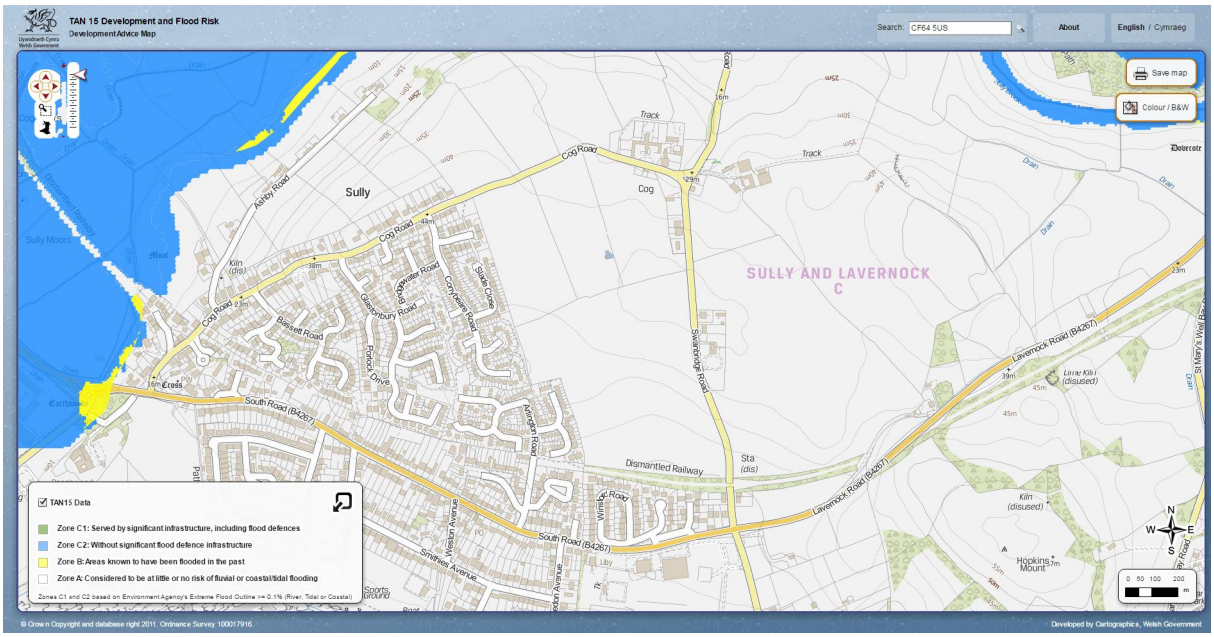
Historical Flooding

4.1 With the correspondence completed for Phase 1, NRW advised that there are no records of historic flooding on the site from any flood source.

4.2 However, the Vale of Glamorgan Council advised that there are flooding issues associated with properties to the south-west of the site, including Conybeare Road. This could be contributed to by overland flows generated from within the site – and therefore a consideration for the surface water drainage strategy in the aspiration to provide off-site betterment.

Fluvial and Coastal/Tidal Flooding

4.3 As outlined previously, the site is located in DAM Zone A, which is considered to be at little or no risk of fluvial or coastal/tidal flooding. This source of flooding therefore does not warrant any further consideration – and is considered to represent negligible risk to the site.



Development Advice Map – extracted from Wales Government website

Surface Water Flooding

4.4 Surface water flooding is a result of overland flow that can follow a rainfall event, before the runoff enters a watercourse or sewer. This form of flooding is usually associated with high

intensity rainfall events but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen, developed or otherwise has a low permeability.

4.5 The Risk of Flooding from Surface Water map has been obtained for the site from the Natural Resource Wales website, as shown below.

Surface water flood map – extracted from NRW website

4.6 The severity of flood risk from surface water sources is indicated by different flood zones, classified as either:

- **Very low** (no shading) – an area that has an annual chance of flooding of less than 1 in 1000 (0.1%);
- **Low** (yellow shading) – an area that has an annual chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%);
- **Medium** (orange shading) – an area that has an annual chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%); and
- **High** (brown shading) – an area that has an annual chance of flooding of greater than 1 in 30 (3.3%).

4.7 The surface water flood map shows that the site is predominantly located in an area where there is a very low risk of surface water flooding. As such, the consequences from this source of flooding are considered to be negligible and manageable.

4.8 Whilst there are two minor isolated areas where surface water flooding is a higher risk over the site and surrounding area, these areas are located adjacent to the west site boundary. This is a result the east-west slope through the site. The extent of surface water flooding identified is marginal. Furthermore, following development the surface water runoff generated on the site will be accommodated by a formalised drainage network and consequently any isolated areas of flooding are likely to be removed.

4.9 This source of flooding is therefore considered to represent a low risk to the site.

Drainage and Infrastructure Flooding

4.10 Drainage and infrastructure flooding occurs when sewerage systems are overwhelmed, surcharge and spill onto the surface. This may occur alone or be combined with other flood sources (e.g. fluvial or surface water). The sewerage maps and correspondence from DCWW for the site and surrounds are included in Appendix C.

4.11 There is very limited drainage infrastructure located up gradient of the site and this source is therefore considered to represent a negligible flood risk to the site.

Groundwater Flooding

4.12 The Vale of Glamorgan Council Local Flood Risk Management Strategy (2013) reports on various local flood incidents, some of which are thought to have been caused as a result of groundwater flooding across the administrative area. However, it states that limited historic evidence of this type of flooding is available.

4.13 Maps of Areas Susceptible to Groundwater Flooding are incorporated into the Local Flood Risk Management Strategy. These are derived from generic national geological mapping, but is currently the best dataset available. It reveals that the site is not subject to groundwater flood risk. This conclusion appears sound, considering the hilltop location and the nature of the underlying geology. This source is therefore considered to represent a negligible flood risk to the site.

Other Sources of Flooding

4.14 Other sources of flooding can include non-natural or artificial sources such as reservoirs, lakes, canals etc.

4.15 There are no canals located within the vicinity of the site and flood risk from this source is therefore negligible.

4.16 Whereas the Environment Agency's Risk of Flooding from Reservoirs Map shows the site to be outside the maximum extent of flooding from reservoirs. Therefore, the flood risk from this source is considered to be negligible.

Flood Mitigation

4.17 All sources of flood risk for the area proposed for built development have been identified to be low or negligible and flood risk mitigation measures are not required.

4.18 However, finished floor levels should be elevated above surrounding ground levels by at least 150mm in accordance with building regulations, which will provide residual protection the very remote chance of flooding those flood sources identified to represent a low flood risk.

4.19 To meet with national and local planning policy, a strategy will need to be outlined to demonstrate how surface water runoff from the proposed development would be managed.

4.20 This strategy is described in Section 5, and outlines the sort of drainage features that would be required to prevent an adverse impact on flood risk with the change of the land use from greenfield surface to a developed area, and also whether an infiltration-led and/or attenuation-led strategy is likely to be the most suitable.

5 SURFACE WATER DRAINAGE STRATEGY

5.1 Guidance on surface water runoff from development is given in TAN15. In addition, there are the particular requirements of the NRW and the relevant polices from the Local Plan, as described in Section 3 together with the Sustainable Drainage Systems Standards for Wales.

5.2 TAN15 advises that all types of land use change will impact on the hydrological cycle in one way or another and flooding is not confined to floodplains, as heavy rain falling on waterlogged ground can cause localised flooding almost anywhere. In all flood zones, development should not increase the risk of flooding elsewhere. Runoff from developments in these areas can, if not properly controlled, result in flooding at other locations and significantly alter the frequency and extent of floods further down the catchment.

5.3 Built development, such as roads, pavements, and roofing, tend to increase the surface area of impermeable ground, thus reducing percolation and increasing rapid surface run-off. This has the effect of reducing the time it takes for precipitation to enter the watercourse and consequently increasing the peak discharge. Sustainable Drainage Systems (SuDS) can perform an important role in managing run-off from a site and should be implemented, wherever they will be effective, in all new development proposals, irrespective of the flood zone in which they are located.

5.4 Development may increase run-off and hence flood risk in other areas, therefore, the aim should be for new development not to create additional run-off when compared with the undeveloped situation, and for re-development to reduce run-off where possible. Whilst TAN15 advises that it is accepted that there may be practical difficulties in achieving this, the aim of this surface water drainage strategy is to achieve this.

Methodology

5.5 The objective of the surface water drainage strategy is to ensure that there are no residual adverse impacts on flood risk over the site and elsewhere in the catchment as a consequence of the proposed development through provision of a sustainable approach to the management of surface water runoff. This assessment will:

- Analyse the changes in land use as a consequence of the development;
- Determine the existing runoff rates;

- Estimate the required measures to mitigate / manage the increase in runoff; and
- Outline a conceptual surface water drainage strategy.

Proposed Receptor of Site Runoff

5.6 Standard S1 (surface water runoff destination) of the Sustainable Drainage Systems Standards for Wales, identifies a drainage hierarchy, which aims is to ensure that runoff is treated as a resource and managed in a way that minimises negative impact of the development on flood risk, the morphology and water quality of receiving waters and the associated ecology.

5.7 Standard S1 has been presented below.

S1 Surface water runoff destination

Priority Level 1: Surface water runoff is collected for use;

Priority Level 2: Surface water runoff is infiltrated to ground;

Priority Level 3: Surface water runoff is discharged to a surface water body;

Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system;

Priority Level 5: Surface water runoff is discharged to a combined sewer.

5.8 The Sustainable Drainage Systems Standards for Wales states that Priority Levels 4 and 5 should only be used in exceptional circumstances.

5.9 It is possible that some water can be collected by water butts for the watering of gardens (i.e. Priority Level 1). However, this is not sufficient for the management of surface water runoff for extreme rainfall events – as it will offer limited storage and there is a reliance on a system that may not be fully drained. Whilst there is likely to be some infiltration, ground conditions are thought unlikely to permit the use of infiltration-led strategy (i.e. Priority Level 2) for the management of surface water runoff (see Section 2). Therefore, in accordance with the drainage hierarchy, runoff will be discharged to a surface water body (i.e. Priority Level 3) using an attenuation-led strategy.

5.10 Surface water will be discharged to the drainage ditch that is located within the south-west corner of the site. Surface water runoff from the site currently informally drains to this feature, so this proposed connectivity will be retaining the existing conditions.

5.11 In order to meet with the requirements of TAN15, surface water that is discharged into this drainage ditch must be restricted to greenfield runoff rates and volumes.

Existing Greenfield Runoff Rates

5.12 The ICP SuDS Method has been used within Micro Drainage to calculate the existing greenfield runoff rates. The parameters utilised are detailed in Table 1 below. Whereas the calculated rates are presented in Table 2. The summary sheet from this is included in Appendix F.

5.13 The greenfield runoff rates for the proposed development were calculated based on the amount of developable area within the site – instead of the gross area. The developable area therefore excludes the green corridors and green landscaped areas. Greenfield runoff rates have been calculated based on the illustrative masterplan that is included in Appendix A.

Table 1: ICP SuDS parameters

Parameter	Value	Unit
Area	5.0	ha
SAAR	957	mm
Soil class	0.15	
Region	9	
Urban	0	%

Table 2: ICP SuDS results

Developable Area (ha)	Return Period	Peak Greenfield Discharge (l/s)	Peak Greenfield Discharge (l/s/ha)
5.0	QBAR	2.9	0.58
5.0	Q1	2.6	0.52
5.0	Q30	5.1	1.02
5.0	Q100	6.4	1.28

5.14 These peak runoff rates are low, which is a result of the permeable soil class identified by Micro Drainage. This therefore provides further evidence that some infiltration may be achievable on site – as low peak runoff rates are typically associated with areas where rates are favourable for infiltration. It is recommended that infiltration testing is undertaken at a later stage – to ascertain the rates that can be used in the design of the drainage strategy.

Proposed Surface Water Drainage Strategy

5.15 SuDS will be utilised to manage surface water runoff from the site. This will be in the form of an attenuation storage feature located alongside the west site boundary.

5.16 The SuDS Manual (CIRIA, 2015) and the Sustainable Drainage Systems Standards for Wales have been considered during the preparation of this outline surface water drainage strategy for the development site.

5.17 Based on the topographical survey of the site, the proposed development comprises a single catchment that discharges towards the drainage ditch that is located in the south-west corner of the site. It is therefore proposed to discharge runoff from the proposed development at controlled rates through the use of onsite SuDS – with a detention basin the primary feature.

5.18 The concept of sustainable drainage is that environmental and social factors such as the quantity and quality of runoff and amenity value of surface water in the urban or developed environment are considered when making decisions about drainage. SuDS can be used to compliment or replace conventional piped urban drainage to recreate the natural water cycle. This process can be used in certain locations to reduce or even eliminate the existing problems associated with such systems: risk of flooding, potential of pollution or poor water quality and damage to the natural environment.

5.19 A wide range of drainage systems and techniques can be categorised as SuDS. From site wide installations (wetlands, ponds) to domestic source control (green roofs), the scale of SuDS schemes and their benefits can vary widely. For relatively large development such as this, it is often necessary to incorporate a combination of site control and source control measures within the overall strategy.

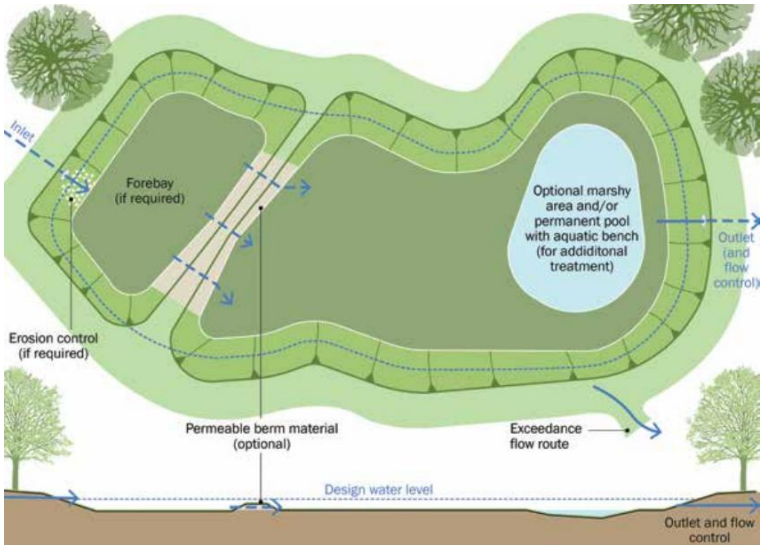
5.20 Based on the underlying geology, some limited infiltration may be achievable. It is therefore recommended that the detention basin is designed to allow infiltration to occur. This will reduce the attenuation volume required and will mimic natural conditions better.

5.21 The detention basin will be located alongside the west boundary of the site. The basin will be designed to attenuate runoff prior to controlled discharge to the drainage ditch at greenfield rates. Detention basins are essentially vegetated depressions incorporated into the form of the site, and are designed to impound surface water runoff from extreme storms and gradually release it. These features are set into existing ground levels to create a storage basin, with embankments used to temporarily hold water until it gradually drains through to dry.

5.22 The detention basin would be designed in accordance to the standards set out in the CIRIA SuDS Manual (2015). The preliminary design of the detention basin that is to be used here

includes an upper and lower tier – with the upper tier for accommodating more extreme rainfall and the lower tier for the more frequent rainfall events. This lower part of the basin is a transient environment suited to wetland flora and fauna. The incorporation of a more permanently wet pond in this area is also possible, set below the level of the outfall from the feature to the adjacent drainage ditch, with this helping to enhance water quality treatment. In addition to the management of surface water runoff, this feature would also therefore benefit the local biodiversity and add value to landscape, visual amenity and recreation.

5.23 The CIRIA SuDS Manual (2015) provides an example of a typical plan view and profile of a detention basin illustrating how the feature would look on the site, as included below.



5.24 The site is not at risk of flooding (see Section 3) and therefore there are no restrictions on a suitable location for above ground attenuation storage. The detention basin has been located near to the lowest point in Phase 2 to allow it to serve the developed area. The detention basin was not included at the very lowest level given the need to provide an outfall from the feature that would drain under gravity to the drainage ditch. As such, land levels of the developed areas south of the basin may need to be uplifted slightly to enable these to drain to the basin. This provides a suitable location for the material excavated to form the basin.

5.25 A plan of the conceptual surface water drainage strategy is enclosed in Appendix F – including a cross-section of the detention basin. A Micro Drainage quick storage estimate was undertaken to determine the amount of attenuation storage that would be required to accommodate surface water runoff from the developed part of the site for all events up to and including a 1 in 100-year plus climate change event (30% increase in peak rainfall

intensity). A 60% impermeable ratio of the proposed developable area has been assumed (i.e. 5.0 x 0.6 = 3.0ha). This is a conservative assumption considering the relative low density of the illustrative masterplan. These calculations are also enclosed in Appendix F.

5.26 Table 3 presents the variables included in the quick storage estimate.

Table 3: Quick storage estimate variables

Variable	Value	Unit
Return period	100	
Impermeable area	3.0	ha
Max allowable discharge	15.1	l/s
Infiltration	0.0036	m/hr
Climate change	30	%

5.27 The drainage strategy has been based on attenuation of up to and including the 1 in 100-year plus climate change event (i.e. 30% increase in peak rainfall intensity) to the QBAR greenfield runoff rate (2.9l/s). This will be achieved using as hydroslide (or similar). This rate has been adopted to ensure the long term storage volume has been accommodated so that the volume of surface water that is discharged from the site has also been managed.

5.28 The rate of 2.9l/s is below that usually recommended to avoid blockage of the outlet control (i.e. hydroslide). A minimum rate of 5l/s tends to be used to mitigate for the risk of blockage. Consequently, the attenuation volume calculation is considered to be somewhat conservative.

5.29 This restriction of runoff rates would significantly reduce the existing rate of runoff discharged from the site in extreme rainfall conditions. Following the correspondence with the Vale of Glamorgan Council, this could also help alleviate the off-site flooding that is understood to be associated with properties to the south-west of the site, including Conybeare Road.

5.30 A minimal infiltration rate has been adopted in the calculation for sizing the detention basin. This was intended to mimic the loss of water from the detention basin through its base.

5.31 The total attenuation volume of storage required for equates to approximately 2,500m^3, as shown in the surface water drainage design included in Appendix F. This attenuation volume is the mid-value in the storage computed using the Micro Drainage Quick Storage Estimate.

5.32 The drainage strategy has been prepared to demonstrate the proposed development can meet national and local requirements. Further development of the drainage strategy will be required during the detailed design stage of the project (i.e. at Reserved Matters stage).

5.33 It is recommended that site investigation is undertaken to investigate infiltration rates. This should be undertaken to inform the detailed design of the feature at a later stage.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 This Flood Consequence Assessment has been undertaken to accompany an outline planning application for the development of the southern (Phase 2) land at Swanbridge Road, Sully.

6.2 This report has been prepared by Vectos on behalf of Taylor Wimpey in accordance with the guidelines set out in Technical Advice Note 15 (TAN15) on Development and Flood Risk together also with relevant local planning policy. The following conclusions are made:

- There are no known historical flood incident records for the site.
- The site is located in DAM Zone A – little or no risk of fluvial or tidal flooding.
- All sources of flooding have been assessed to represent a negligible or low risk.
- No specific flood mitigation is required to protect the site from flood sources.
- However, finished floor levels should be elevated above surrounding ground levels by at least 150mm in accordance with building regulations.

6.3 The desktop study was not conclusive with respect to the suitability of infiltration for management of surface water. However, enough evidence was considered to be available to confirm that an infiltration-led strategy would not be practical as the stand-alone solution. Consequently, attenuation of surface water, with connectivity to an adjacent drainage ditch was proposed. An informal connection from the site to this drainage ditch is already present.

6.4 A detention basin has been proposed to offer the attenuation required. The basin will also allow for infiltration into the underlying ground, if ground conditions permit it. Conservative infiltration rates have been incorporated into conceptual design.

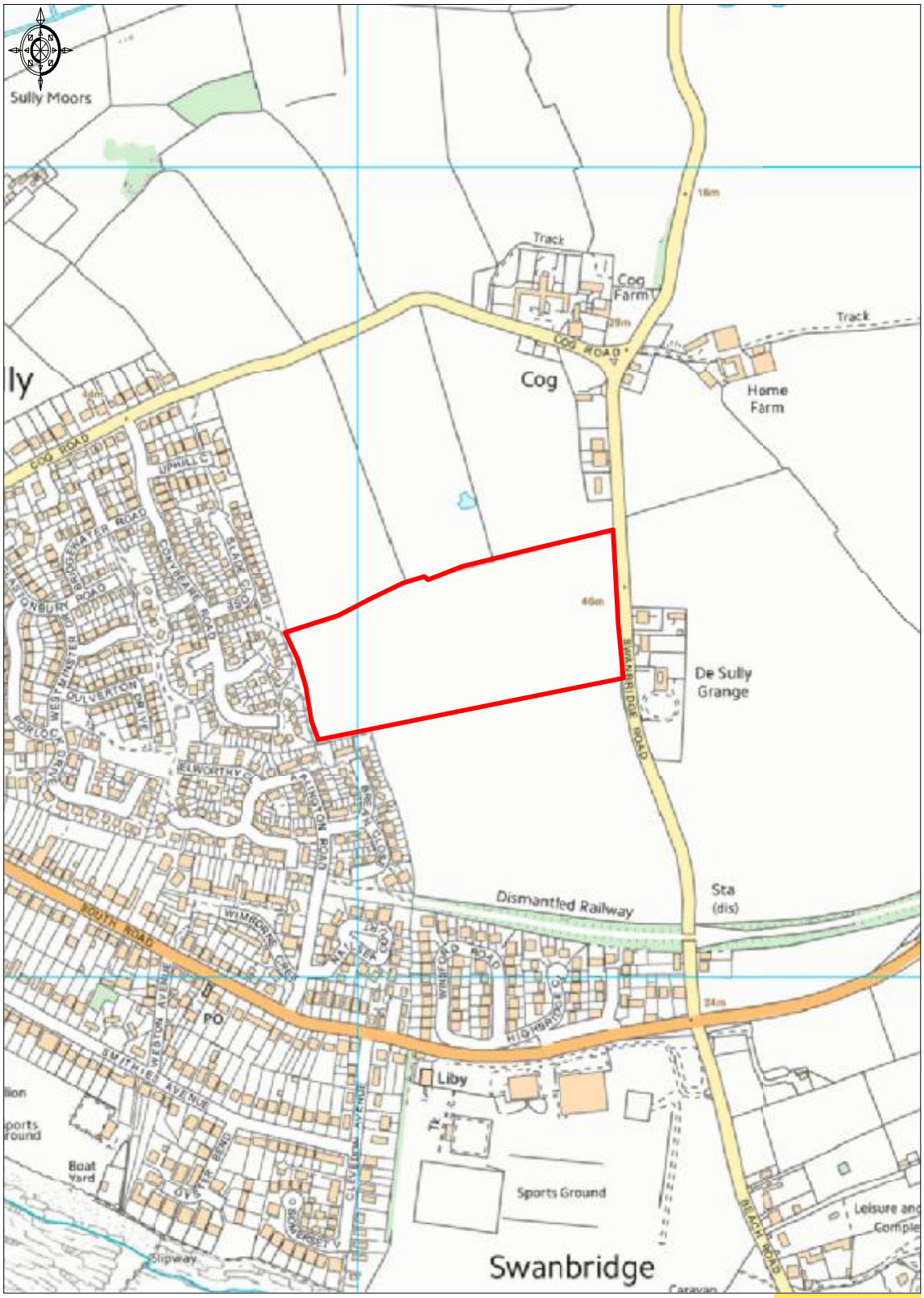
6.5 In order to meet with the requirements of TAN15 and aspirations of NRW, surface water discharged following the development of the site must be restricted to greenfield runoff rates.

6.6 The surface water drainage strategy has been designed to accommodate the 1 in 100-year rainfall event including climate change (30% increase in peak rainfall intensity) and has been based on the principles of Sustainable Drainage Systems (SuDS).

6.7 The surface water drainage strategy will be subject to detailed design – developing the concepts that have been defined here and therefore completed at a later stage. This should be informed through the completion of infiltration testing and also with the clearance and survey of the drainage ditch that is located in the south-west corner of the site.

Appendix A Location Plan, Parameter Plans and Illustrative Masterplan

Land South of Cog Road, Sully (Land south of the hedgerow)
Site Location Plan



Promap®

savills

LAND AT COG ROAD, SULLY (SOUTH SITE)

Indicative Masterplan

1:1000 @ A2

Landscaping / Amenity

Housing

Ecology Reserve (partly delivered in approval 01279/OUT)

P.O.S (Play and Amenity)

SUDS and with Landscape Amenity

Primary Hedgerows (partly delivered in approval 01279/OUT)

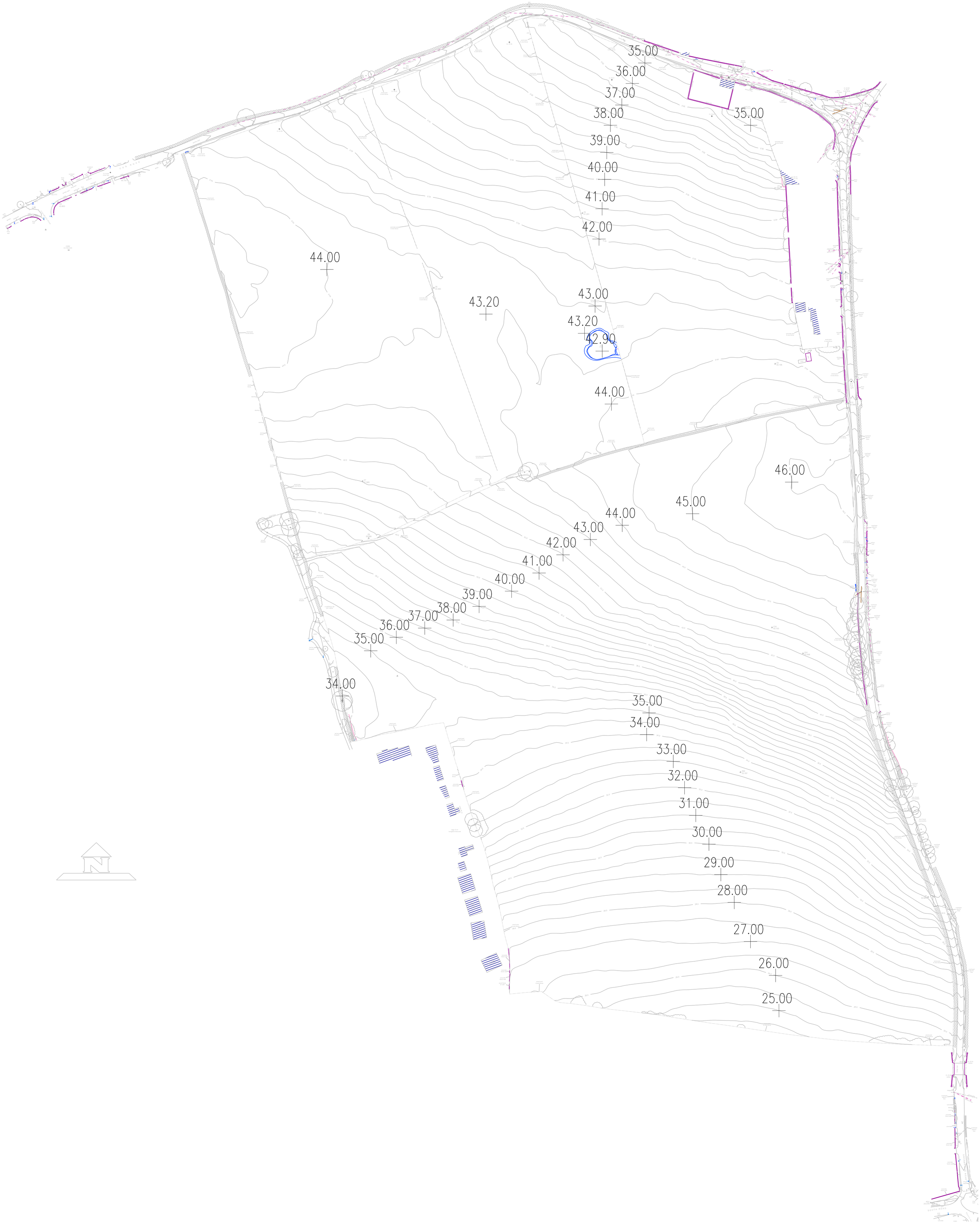
Retained Hedgerows

Phase 1 Inc. 'SUDS' Feature

Phase 2 Inc. Ecological Mitigation Area

Phase 3

Appendix B Topographic Survey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SOUTH ROAD

Appendix C DCWW Correspondence and Asset Management Plans

Sully Moors

Cog Farm

Cog

Home Farm

SULLY

Dŵr Cymru
Welsh Water

Land at Sully, The Vale of Glamorgan

N
W E
S

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow (CO)
- Special purpose chamber (SPC)
- Treatment works
- Pumping station
- Outfall
- Lamphole (LH)
- Storm Overflow
- Rising main
- Gravity sewer
- Private sewer
- Private sewer subject to Sect. 104 adoption agreement (S 104)
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB: Sewer symbol colour indicates the type.

RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dwr Cymru Cyf gives this information as to the position of its underground apparatus by way of general guidance only on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the Company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. It must be understood that the furnishing of the information is entirely without prejudice to the provision of the New Roads and Streetworks Act 1991 and of the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref:	316185,168395
Map scale:	1:5,000
Printed by:	AK
Printed on:	05/08/2016

Sully Moors

Cog Farm

Cog

Home Farm

SULLY

Dŵr Cymru
Welsh Water

Land at Sully, The Vale of Glamorgan

N
W E
S

LEGEND

Clean network:

- Sluice valve
- Pressure reducing valve
- Meter
- Bulk meter
- Hydrant (FH)
- Cap end
- Air valve
- Stop tap
- Water Treatment Works
- Water Pumping Station
- Existing main
- Non-operational main
- Raw Water

NB: Water main symbol colour indicates the type.

LIGHT BLUE - Trunk
DARK BLUE - Distribution
YELLOW - Raw Water

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dwr Cymru Cyf gives this information as to the position of its underground apparatus by way of general guidance only on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the Company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. It must be understood that the furnishing of the information is entirely without prejudice to the provision of the New Roads and Streetworks Act 1991 and of the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref:	316185,168395
Map scale:	1:5,000
Printed by:	AK
Printed on:	05/08/2016

Andrew Clay

Subject: Re.PLS0009421. Notification

Dear Sirs,

Thank you for your email.

Regarding your question about any easement and/or limitations I have forwarded your email to our estates department. They hold the records for these and will be able to find out if anything applies.

Unfortunately our mapping system doesn't hold the depth of the pipe, this would need to be established on site. We can offer to send out a Network Technician to establish this and to physically map all pipes in the area but there is a fee of £85.20 for this. Alternatively third party companies can provide a similar service.

Lastly, regarding material and size of the pipes, the rising main on the left is 150mm Cast Iron. The rising main on the right is 150mm uPVC.

Should you have any further questions please don't hesitate to contact one of the team on 0800 917 2652.

Many Thanks

Dŵr Cymru Welsh Water

Alexander Kennedy
Developer Services Administrator | Developer Services | Dwr Cymru Welsh Water
PO Box 3146 | Linea |Fortran Road | Cardiff | CF30 0EH | 0800 917 2652 |Emails: Searches@dwrcymru.com

---

From: Andrew Clay [mailto:Andrew.Clay@vectos.co.uk]
Sent: 05 August 2016 15:07
To: services developer <developer.services@dwrcymru.com>
Subject: RE: Re.PLS0009421. Notification

******** External Mail ********
Dear DCWW – many thanks for the supply of asset information.

Could you please provide more detail on the feature in the image below – it looks like a dual rising foul main sewer? What is the dimension of this, the depth and is there an easement associated with it – and if so, what are the limitations on overlying land use.

Many thanks,

Andy

Andrew Clay
Associate Director

vectos
transport planning specialists

0117 905 8888 (T) 07535 149 504 (M)
Andrew.Clay@vectos.co.uk

Broad Quay House, Prince Street, Bristol, BS1 4DJ

-----Original Message-----
From: Developer.Services@dwrcymru.com [mailto:Developer.Services@dwrcymru.com]
Sent: 05 August 2016 14:51
To: Andrew Clay <Andrew.Clay@vectos.co.uk>
Cc: BPMCopies@dwrcymru.com
Subject: Re.PLS0009421. Notification

Dear Customer,

Thank you for your application.

Please find attached important information.

Best regards,

Developer Services
Dwr Cymru Welsh Water

Andrew Clay

Subject: Re.PLS0009421. Notification

Dear Sirs,

Further to my previous email today I have had an update from our Estates Department. There appears to be no formal easements recorded for these rising mains and this probably arises from the fact that they were constructed at some point between 1930 and 1955 by the local council authority for the time. As they now belong to Dwr Cymru they are protected by our statutory rights and we can stipulate the protected width required in the event of a planning application.

Should you have any further questions please don't hesitate to contact one of the team on 0800 917 2652.

Many Thanks

Alexander Kennedy
Developer Services Administrator | Developer Services | Dwr Cymru Welsh Water
PO Box 3146 | Linea |Fortran Road | Cardiff | CF30 0EH | 0800 917 2652 |Emails: Searches@dwrcymru.com

---

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Many thanks,

Andy

Andrew Clay
Associate Director

0117 905 8888 (T) 07535 149 504 (M)
Andrew.Clay@vectos.co.uk

Broad Quay House, Prince Street, Bristol, BS1 4DJ

-----Original Message-----
From: Developer.Services@dwrcymru.com [mailto:Developer.Services@dwrcymru.com]
Sent: 05 August 2016 14:51
To: Andrew Clay <Andrew.Clay@vectos.co.uk>
Cc: BPMCopies@dwrcymru.com
Subject: Re.PLS0009421. Notification

Dear Customer,

Thank you for your application.

Please find attached important information.

Best regards,

Developer Services
Dwr Cymru Welsh Water

Appendix D Natural Resource Wales Correspondence

Andrew Clay

Subject: Land South of Cog Road, Sully (CF64 5UW) NRW:00610483

Good Afternoon

Thank you for contacting Natural Resources Wales. Please see the following advise provided by our senior Flooding officer:

Surface water run-off should be dealt with by way of a Sustainable Drainage System (SUDS), as required in Section 8.5 of TAN15, in order to attenuate flows and prevent an increased risk of flooding in the catchment. If good reason can be given why SUDS cannot be implemented then any conventional drainage system installed should also provide attenuation. If a conventional system is installed then this should demonstrate an improvement on the status quo prior to discharge to a watercourse.

A Surface Water assessment should be undertaken by the developer at a pre planning /outline planning stage which should include the design of the surface water drainage system and how it will affect the site layout.

• At this stage the applicant should produce the following information:

- Demonstrate how the principles of Sustainable Drainage Systems have been applied to the development identifying what techniques will be used.

- Set aside land specifically for SUDS.

- Estimate the discharge rate for the site. Greenfield discharge rates should be sought on Greenfield sites, and also on Brownfield sites (where possible).

- Estimate the volume of 1 in 100 year attenuation to be provided and what techniques will be used to provide the attenuation.

- Take into account TAN 15 climate change requirements.

Regarding the Surface Water Assessment the above are issues that should be considered at the pre planning/outline planning stage, more detail will be required when a full planning application is received. It is important that a drainage design strategy should be carried out at the outset to identify the options for the design of the surface water drainage system and how it will affect the site layout.

I hope this helps.

Kind Regards

Gareth

Customer Care Team

Cyfoeth Naturiol Cymru/Natural Resources Wales

---------- Original Message ----------

From: Nick Bosanko
Received:
To: Enquiries Queue
Subject: Land South of Cog Road, Sully (CF64 5UW)

Dear NRW

We are preparing a Flood Consequence Assessment (FCA) for the site identified above (also as shown on the attached), which is proposed for approximately 100 residential dwellings.

The site is located in DAM Zone A. As part of the FCA, we will develop a surface water drainage strategy for the site. This will be based on the principles of SuDS.

We are writing to you to provide the opportunity for you to inform the FCA, with respect to any flood or drainage related matters that you see fit.

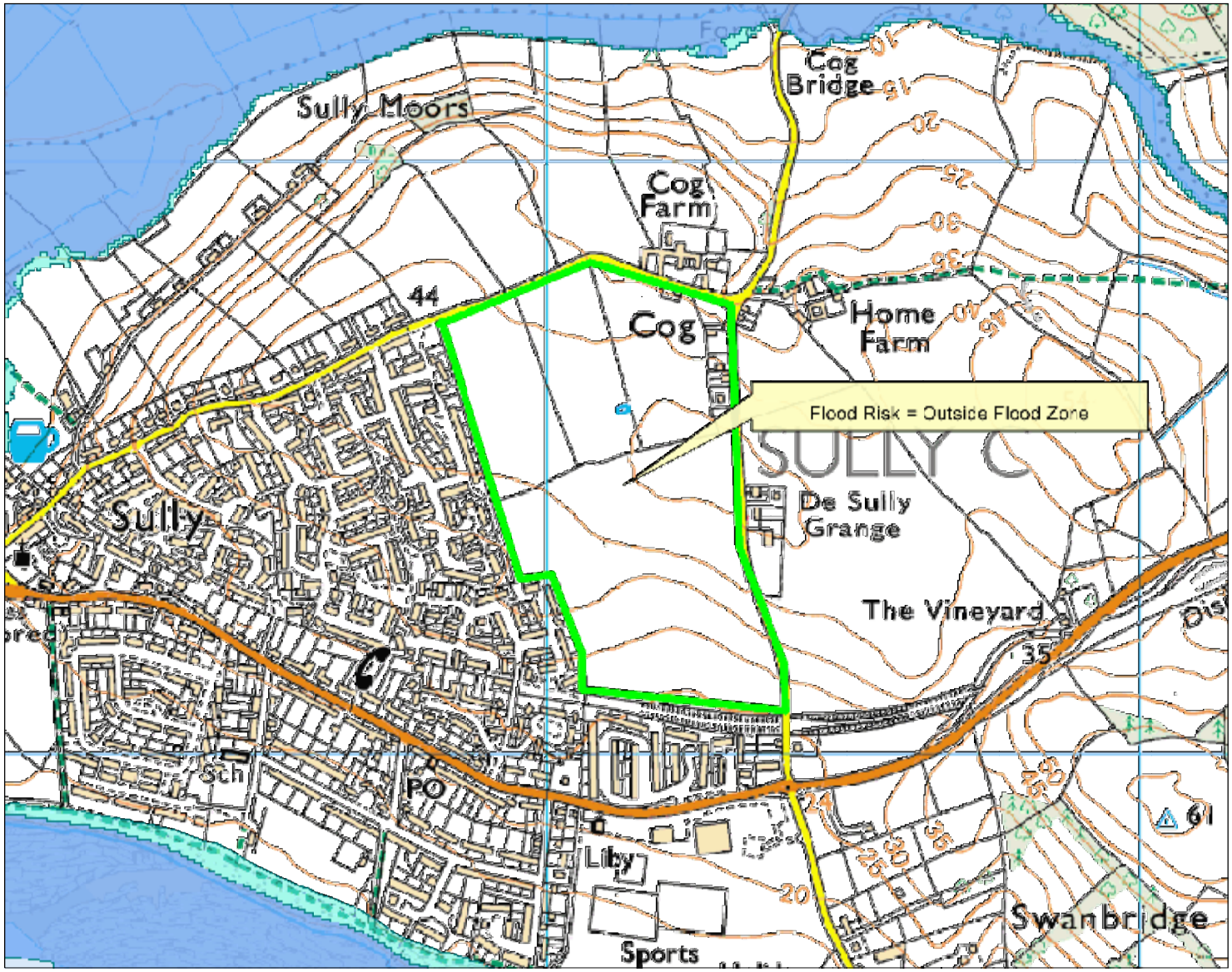
The land located directly to the north is currently the subject of a planning application and has an attenuation led surface water drainage strategy.

We look forward to hearing from you.

Many thanks, Nick

Nick Bosanko
Associate

Flood Map, Centred on Land West of Swanbridge Road, Sully - Created 05 June 2013 [ATI-01615a]



Environment Agency

Scale 1:10,001

N W E S

Flood Map - Defences

Areas Benefiting from Flood Defences

Flood Map - Flood Storage Areas

Flood Map - Flood Zone 3

Flood Map - Flood Zone 2

Flood Likelihood (taking into account defences)

Low: The chance of flooding each year is 0.5% (1 in 200) or less.

Moderate: The chance of flooding each year is 1.3% (1 in 75) or less, but greater than 0.5% (1 in 200).

Significant: The chance of flooding each year is greater than 1.3% (1 in 75).

Outside Blue Areas: Generally this means that the chance of flooding each year from rivers or the sea is less that 0.1% (1 in 1000).

Flood Map Areas (assuming no defences)

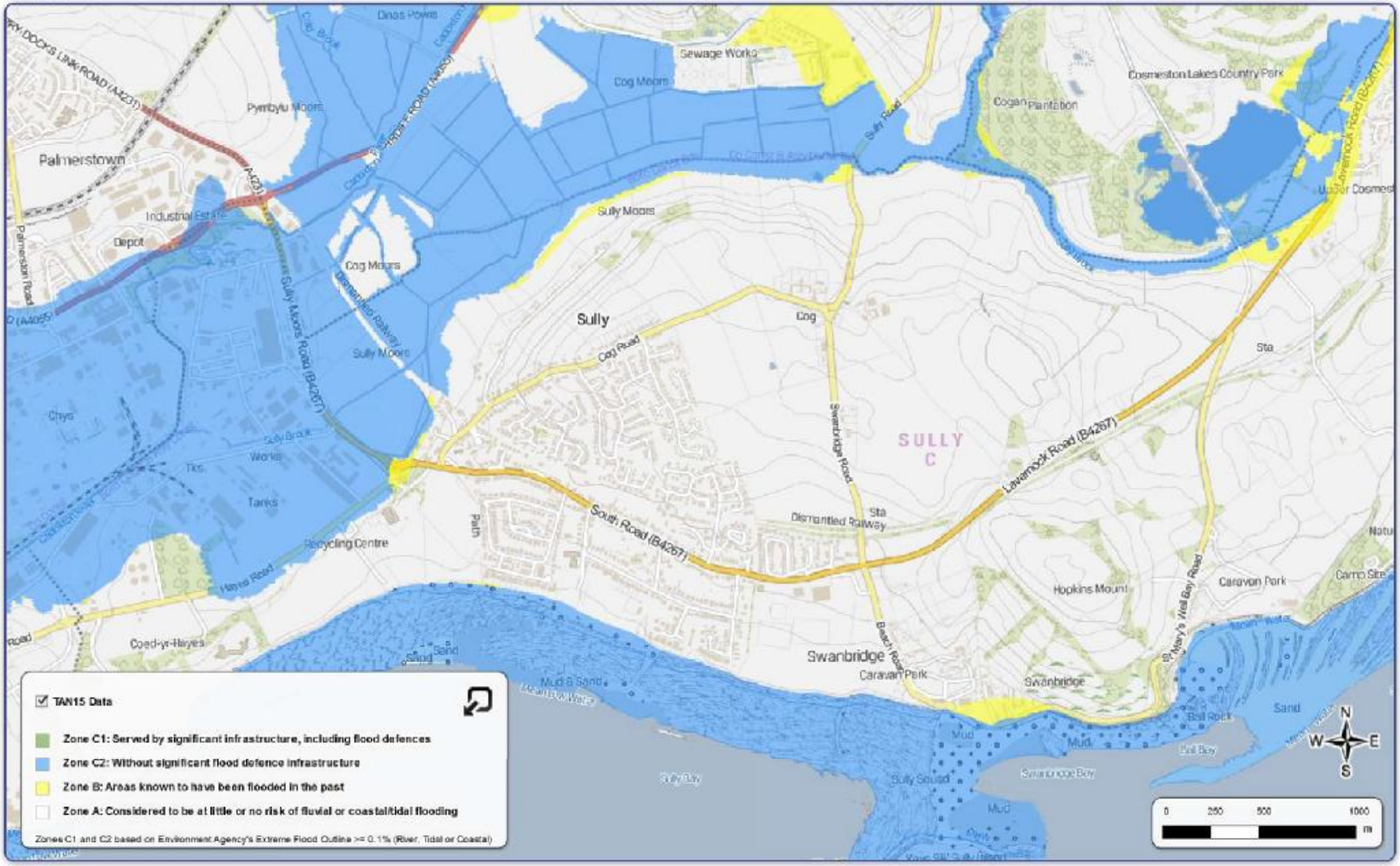
Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

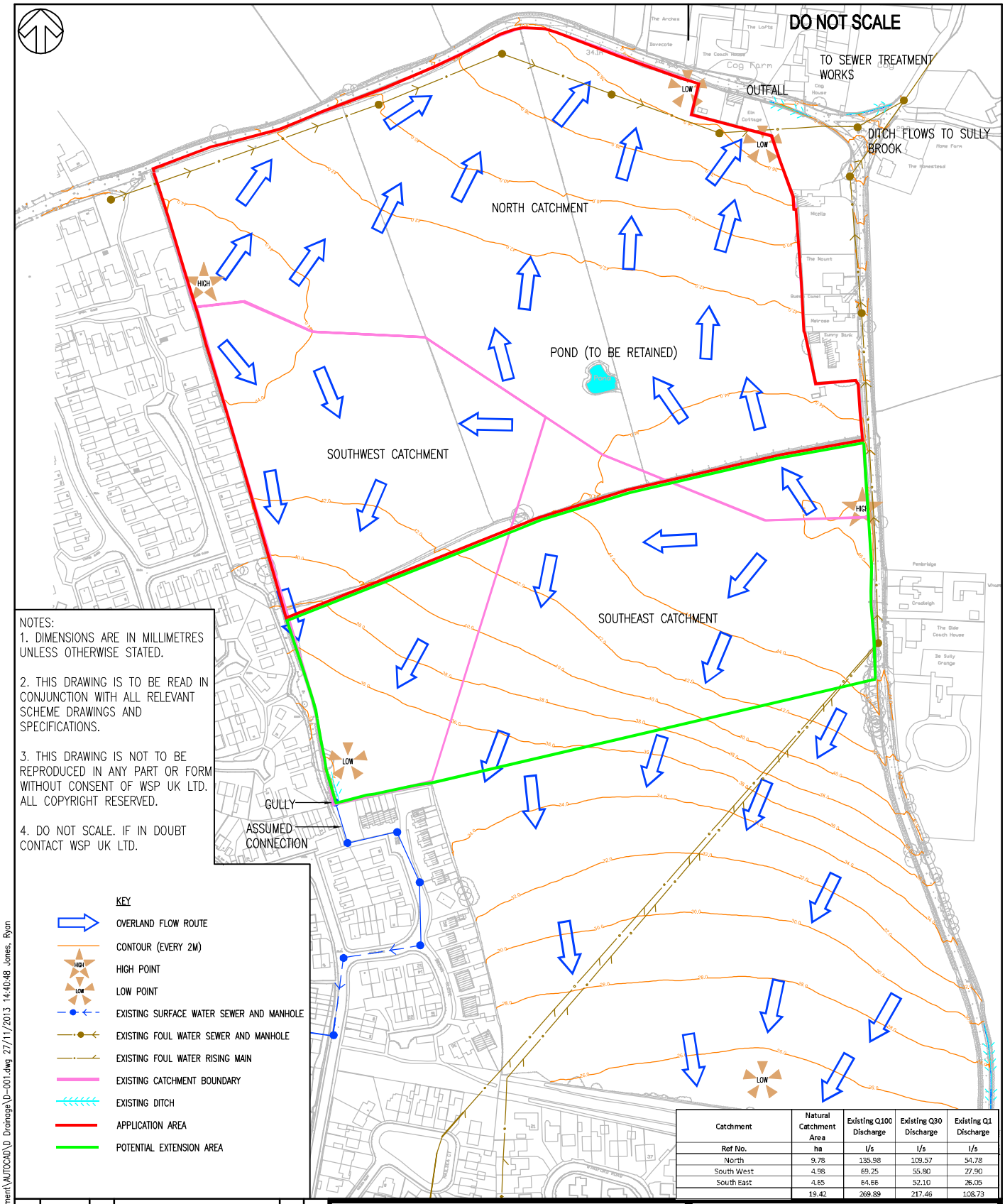
TAN 15 Development and Flood Risk

Development Advice Map



Developed by Cartographics, Welsh Government

Appendix E Phase 1 Drainage Extracts



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KEY

- OVERLAND FLOW ROUTE
- CONTOUR (EVERY 2M)
- HIGH POINT
- LOW POINT
- EXISTING SURFACE WATER SEWER AND MANHOLE
- EXISTING FOUL WATER SEWER AND MANHOLE
- EXISTING FOUL WATER RISING MAIN
- EXISTING CATCHMENT BOUNDARY
- EXISTING DITCH
- APPLICATION AREA
- POTENTIAL EXTENSION AREA

Catchment	Natural Catchment Area	Existing Q100 Discharge	Existing Q30 Discharge	Existing Q1 Discharge
Ref No.	ha	l/s	l/s	l/s
North	9.78	135.98	109.57	54.78
South West	4.98	69.25	55.80	27.90
South East	4.65	64.66	52.10	26.05
	19.42	269.89	217.46	108.73

REV	DATE	BY	DESCRIPTION	CHK	APD
C	27/11/2013	RJ	TITLE AMENDED	MJW	AC
B	28/10/13	RJ	MASTER PLAN AMENDED	MJW	MJW
A	03/07/2013	DF	ISSUED AS DRAFT FOR INFORMATION	MJW	MJW

SCALE @ A3: 1:2500 | CHECKED: MJW | APPROVED: AC

DRAWING STATUS: FOR INFORMATION ONLY

WSP
One Queens Drive Birmingham West Midlands B5 4PJ
Tel: +44 (0)121 352 4700 Fax: +44 (0)121 352 4701
http://www.wspgroup.com

PROJECT: SWANBRIDGE ROAD, SULLY

TITLE: EXISTING DRAINAGE REGIME INCLUDING POTENTIAL EXTENSION AREA

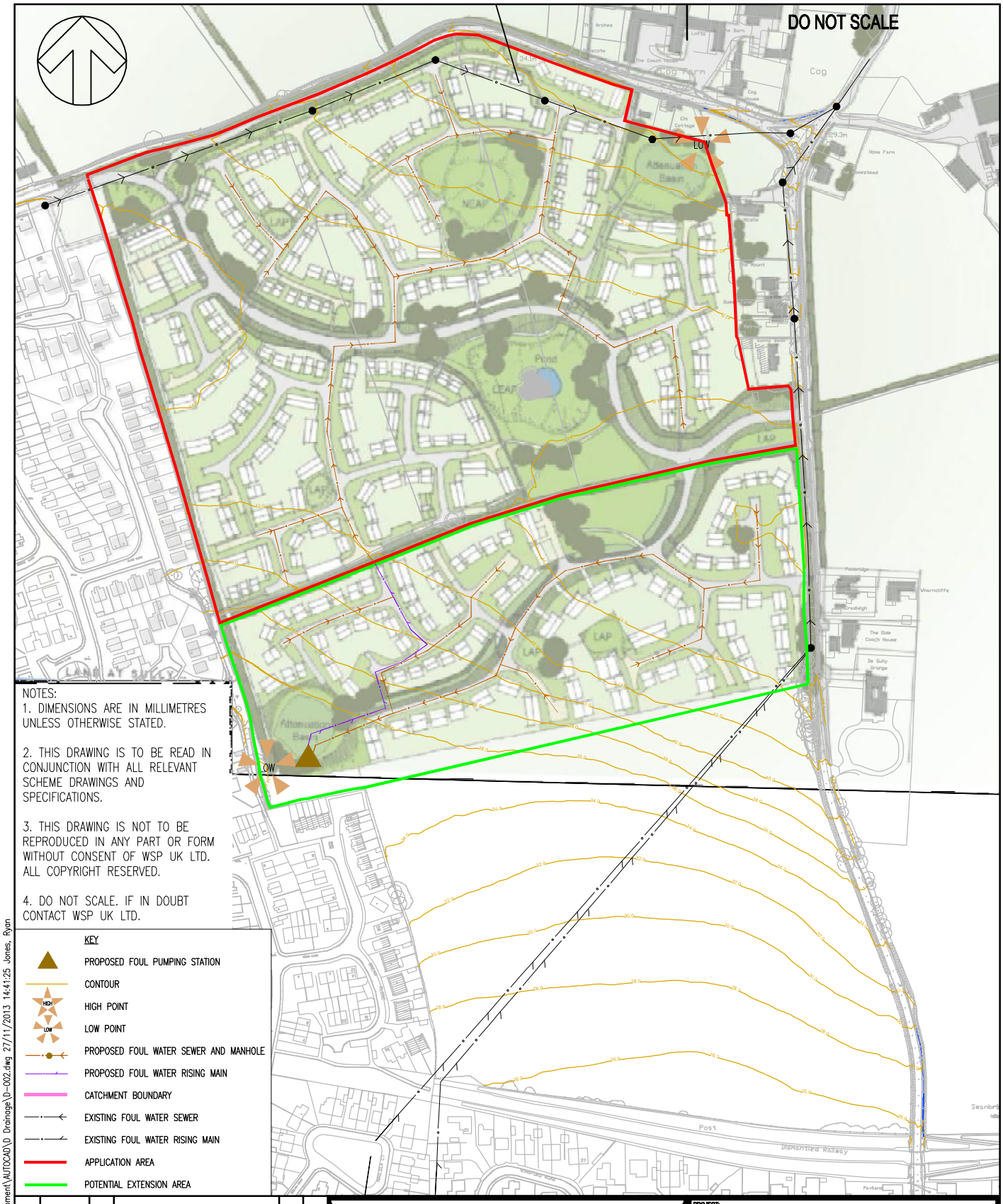
CLIENT: TAYLOR WIMPEY

ARCHITECT: -

CAD FILE: D-001.DWG | DESIGN-DRAWN: DSF | DATE: July 13

PROJECT No: 50600557 | DRAWING No: 0557/D/001 | REV: C

V:\50600557 - Sully FCA\E Models and Drawings\Development\AUTOCAD\D Drainage\D-001.dwg 27/11/2013 14:40:48 Jones, Ryan



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KEY

- PROPOSED FOUL PUMPING STATION
- CONTOUR
- HIGH POINT
- LOW POINT
- PROPOSED FOUL WATER SEWER AND MANHOLE
- PROPOSED FOUL WATER RISING MAIN
- CATCHMENT BOUNDARY
- EXISTING FOUL WATER SEWER
- EXISTING FOUL WATER RISING MAIN
- APPLICATION AREA
- POTENTIAL EXTENSION AREA

REV	DATE	BY	DESCRIPTION	CHK	APD
B	27/11/2013	RJ	TITLE AMENDED	MJW	AC
A	28/10/13	RJ	FIRST ISSUE	©	©

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APPROVED:

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WSP
One Queens Drive Birmingham West Midlands B5 4PJ
Tel: +44 (0)121 352 4700 Fax: +44 (0)121 352 4701
http://www.wspgroup.com

PROJECT: SWANBRIDGE ROAD, SULLY

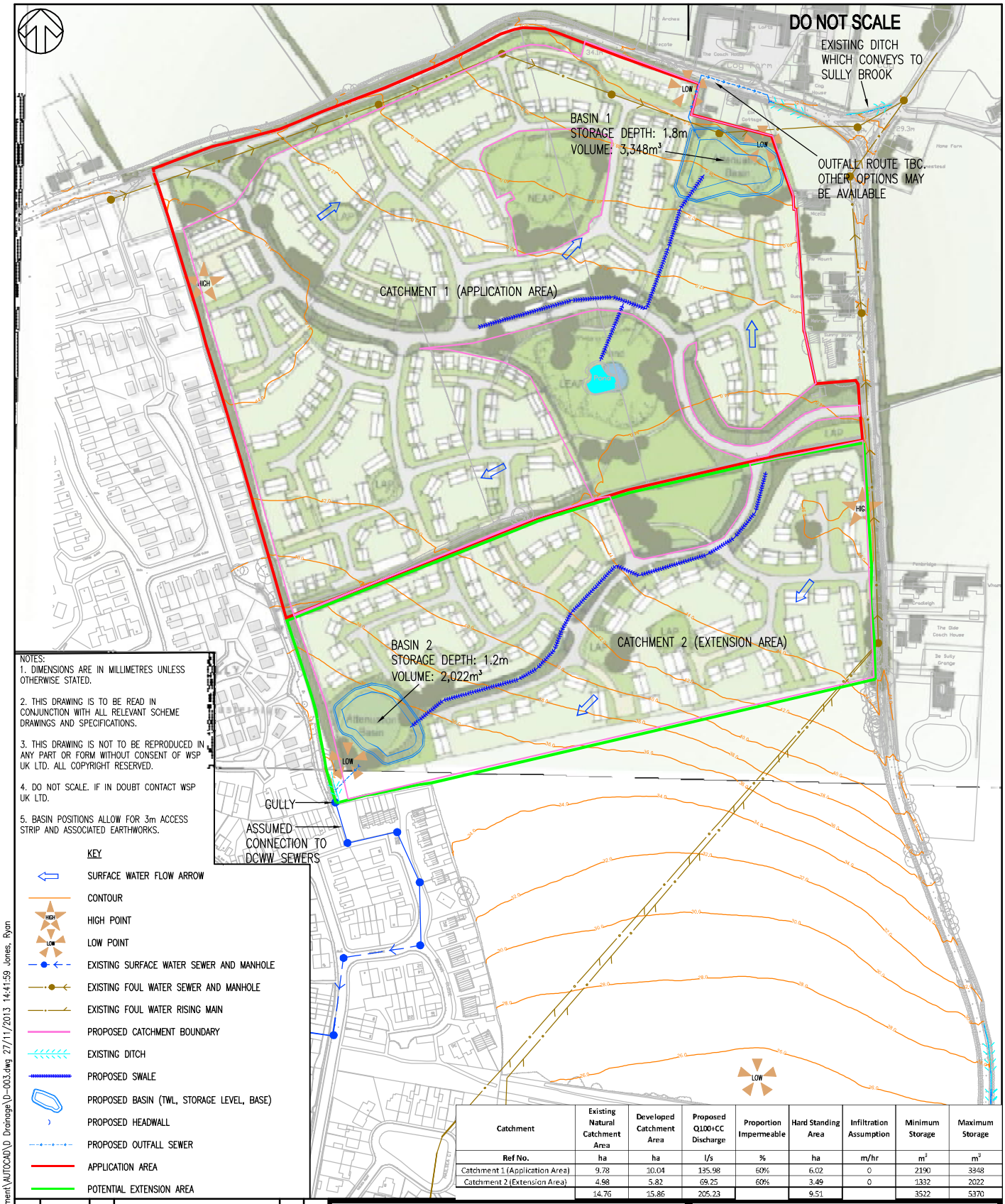
TITLE: INDICATIVE FOUL DRAINAGE STRATEGY INCLUDING POTENTIAL EXTENSION AREA

CLIENT: TAYLOR WIMPY

ARCHITECT:

CAD FILE: D-002.DWG
DESIGN-DRAWN: JS
DATE: July 13
PROJECT No: 50600557
DRAWING No: 0557/D/002
REV: B

V:\50600557 - Sully FCA\E Models and Drawings\Development\AUTOCAD\D Drainage\D-002.dwg 27/11/2013 14:41:25 Jones, Ryan



NOTES:
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5. BASIN POSITIONS ALLOW FOR 3m ACCESS STRIP AND ASSOCIATED EARTHWORKS.

KEY

- SURFACE WATER FLOW ARROW
- CONTOUR
- HIGH POINT
- LOW POINT
- EXISTING SURFACE WATER SEWER AND MANHOLE
- EXISTING FOUL WATER SEWER AND MANHOLE
- EXISTING FOUL WATER RISING MAIN
- PROPOSED CATCHMENT BOUNDARY
- EXISTING DITCH
- PROPOSED SWALE
- PROPOSED BASIN (TWL, STORAGE LEVEL, BASE)
- PROPOSED HEADWALL
- PROPOSED OUTFALL SEWER
- APPLICATION AREA
- POTENTIAL EXTENSION AREA

Catchment	Existing Natural Catchment Area	Developed Catchment Area	Proposed Q100+CC Discharge	Proportion Impermeable	Hard Standing Area	Infiltration Assumption	Minimum Storage	Maximum Storage
Ref No.	ha	ha	l/s	%	ha	m/hr	m^3	m^3
Catchment 1 (Application Area)	9.78	10.04	135.98	60%	6.02	0	2190	3348
Catchment 2 (Extension Area)	4.98	5.82	69.25	60%	3.49	0	1332	2022
	14.76	15.86	205.23		9.51		3522	5370

REV	DATE	BY	DESCRIPTION	CHK	APD
D	27/11/2013	RJ	TITLE AMENDED	MJW	AC
C	25/11/2013	MJW	OUTFALL ROUTE AMMENDED	MJW	AC
B	28/10/2013	RJ	MASTERPLAN UPDATED	MJW	AC
A	20/09/2013	MJW	ISSUED AS DRAFT FOR INFORMATION	MJW	AC

SCALE @ A3: 1:2500 | CHECKED: MJW | APPROVED: AC

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PROJECT: SWANBRIDGE ROAD, SULLY

TITLE: SURFACE WATER DRAINAGE STRATEGY INCLUDING POTENTIAL EXTENSION AREA (ASSUMES NO INFILTRATION)

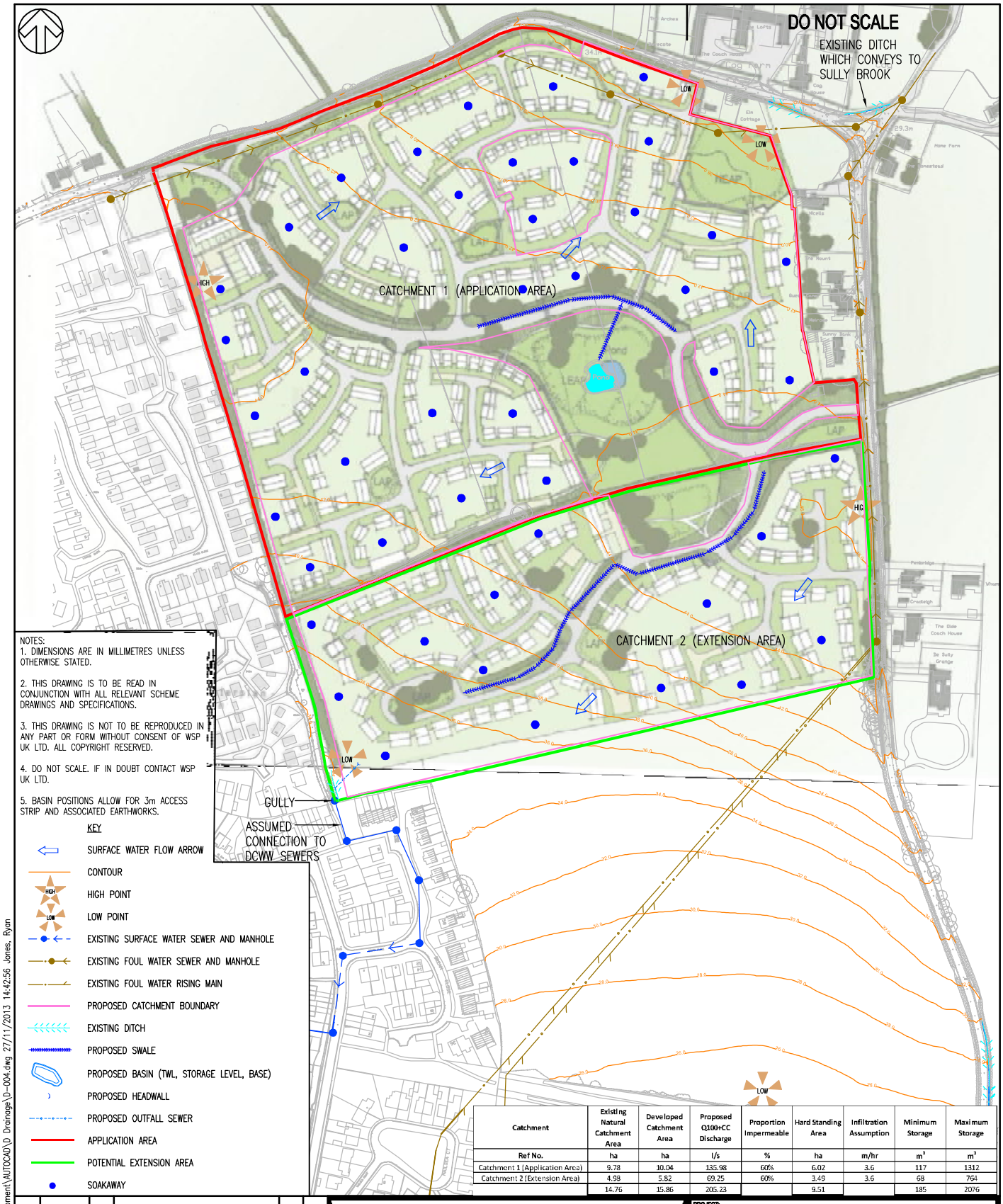
CLIENT: TAYLOR WIMPEY

ARCHITECT: -

CAD FILE: D-003.DWG | DESIGN-DRAWN: MJW | DATE: July 13

PROJECT No: 50600557 | DRAWING No: 0557/D/003 | REV: D

V:\50600557 - Sully FCA\E Models and Drawings\Development\AUTOCAD\D Drainage\D-003.dwg 27/11/2013 14:41:59 Jones, Ryan



NOTES:
1. DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

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5. BASIN POSITIONS ALLOW FOR 3m ACCESS STRIP AND ASSOCIATED EARTHWORKS.

KEY

- SURFACE WATER FLOW ARROW
- CONTOUR
- HIGH POINT
- LOW POINT
- EXISTING SURFACE WATER SEWER AND MANHOLE
- EXISTING FOUL WATER SEWER AND MANHOLE
- EXISTING FOUL WATER RISING MAIN
- PROPOSED CATCHMENT BOUNDARY
- EXISTING DITCH
- PROPOSED SWALE
- PROPOSED BASIN (TWL, STORAGE LEVEL, BASE)
- PROPOSED HEADWALL
- PROPOSED OUTFALL SEWER
- APPLICATION AREA
- POTENTIAL EXTENSION AREA
- SOAKAWAY

Catchment	Existing Natural Catchment Area	Developed Catchment Area	Proposed Q100+CC Discharge	Proportion Impermeable	Hard Standing Area	Infiltration Assumption	Minimum Storage	Maximum Storage
Ref No.	ha	ha	l/s	%	ha	m/hr	m^3	m^3
Catchment 1 (Application Area)	9.78	10.04	135.98	60%	6.02	3.6	117	1312
Catchment 2 (Extension Area)	4.98	5.82	69.25	60%	3.49	3.6	68	764
	14.76	15.86	205.23		9.51		185	2076

REV	DATE	BY	DESCRIPTION	CHK	APD
B	27/11/13	RJ	TITLE AMENDED	MJW	AC
A	28/10/13	RJ	FIRST ISSUE	MJW	AC

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PROJECT: SWANBRIDGE ROAD, SULLY

TITLE: SURFACE WATER DRAINAGE STRATEGY INCLUDING POTENTIAL EXTENSION AREA (ASSUMES INFILTRATION)

CLIENT: TAYLOR WIMPEY

ARCHITECT: -

CAD FILE: D-004.DWG | DESIGN-DRAWN: MJW | DATE: October 13

PROJECT No: 50600557 | DRAWING No: 0557/D/004 | REV: B

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Appendix F Surface Water Drainage Calculations and Concept

ICP SUDS Mean Annual Flood

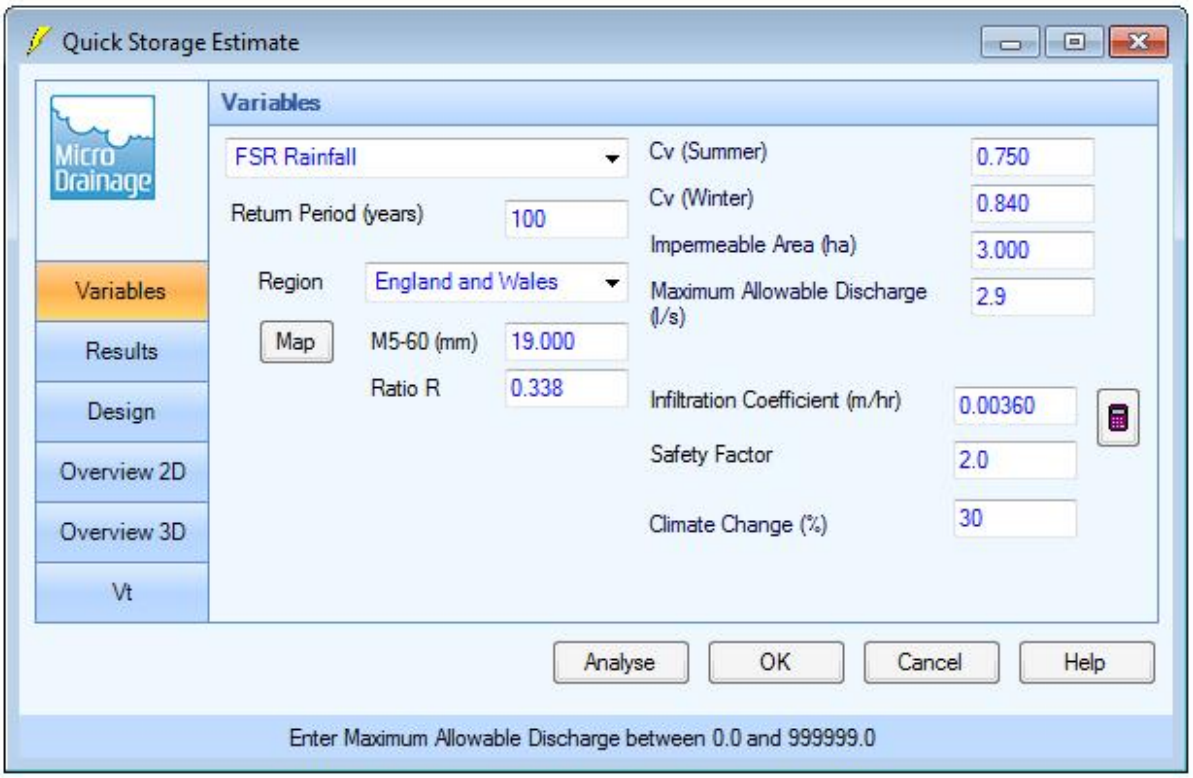
Input

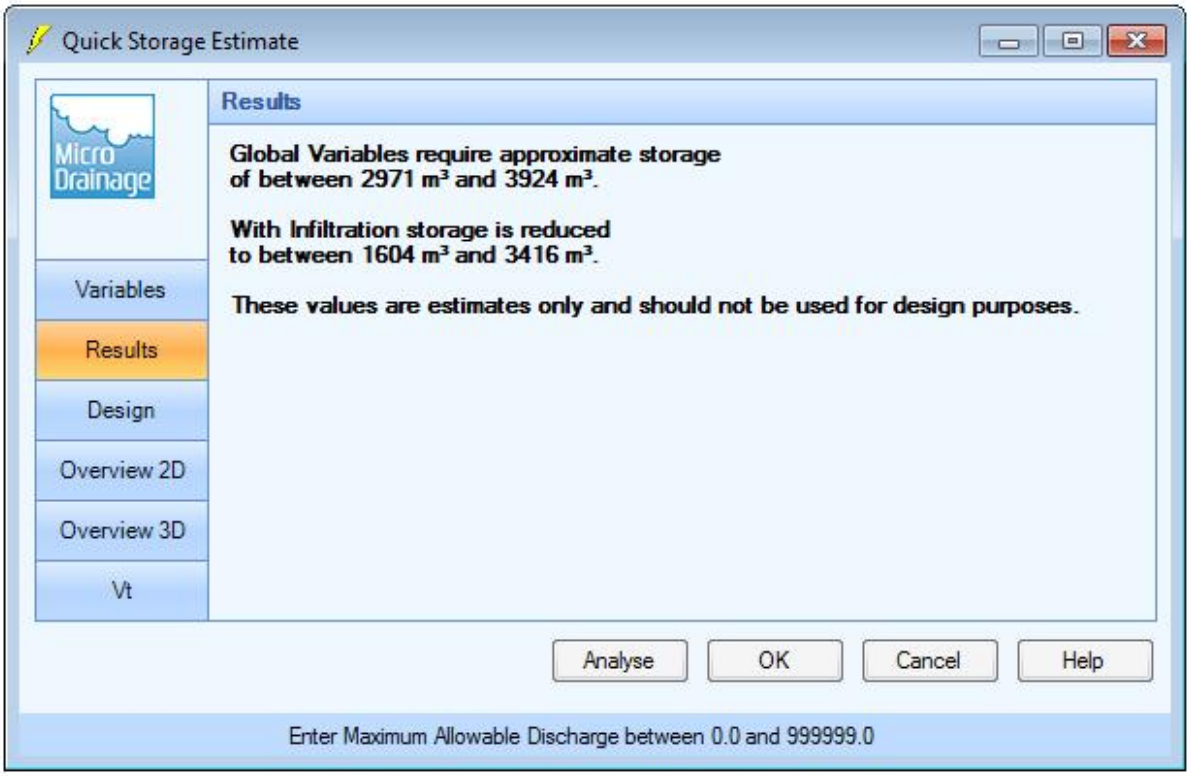
Return Period (years)	100	Soil	0.150
Area (ha)	5.000	Urban	0.000
SAAR (mm)	957	Region Number	Region 9

Results l/s

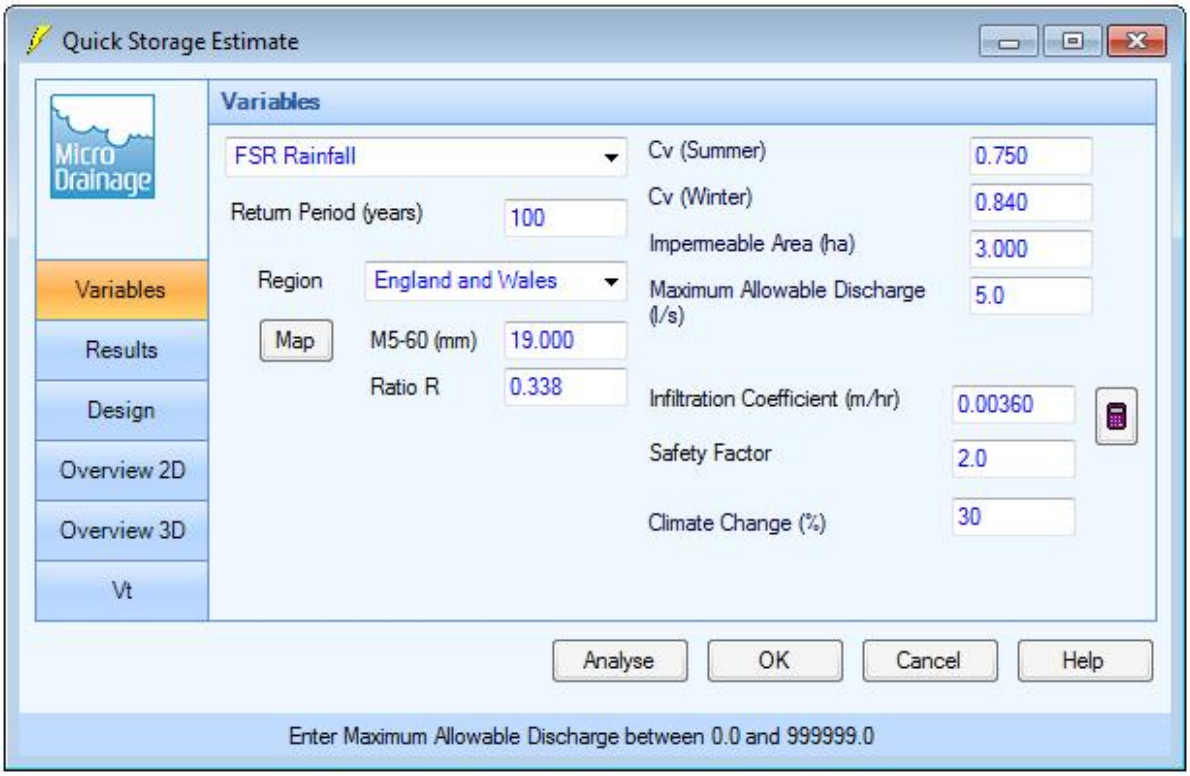
QBAR Rural	2.9
QBAR Urban	2.9
Q100 years	6.4
Q1 year	2.6
Q30 years	5.1
Q100 years	6.4

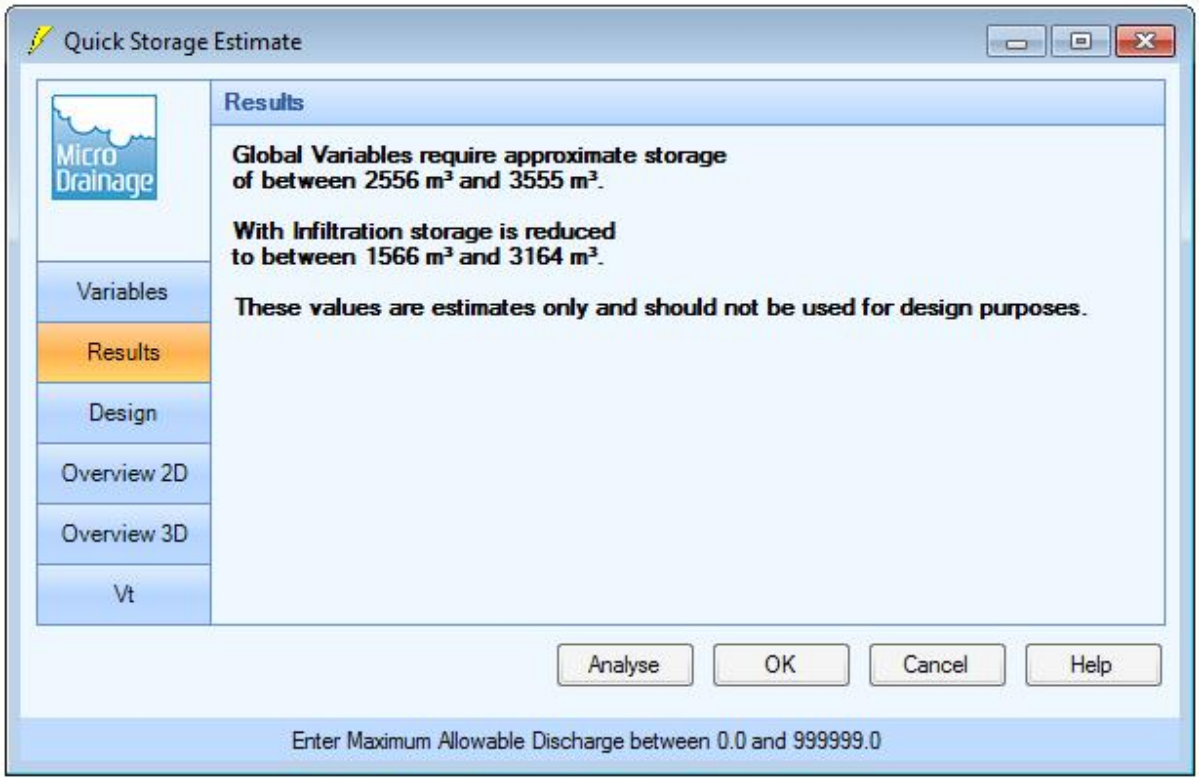
Attenuation Calculation for Developable Area @ QBAR + Min Infiltration

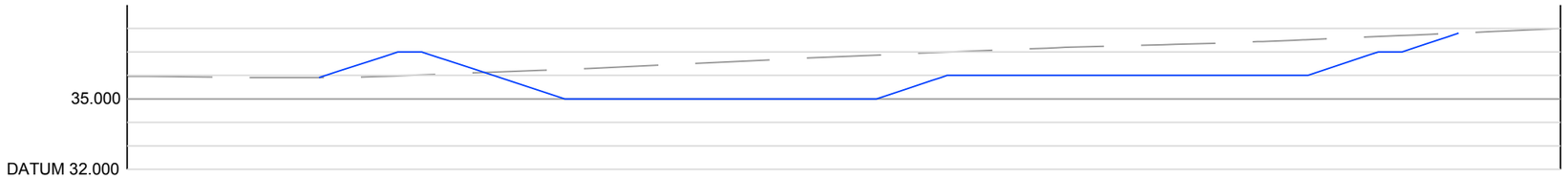




Attenuation Calculation for Developable Area @ QBAR + Min Infiltration + Blockage Avoidance







CHAINAGE	0.000	8.192	10.000	20.000	30.000	40.000	50.000	56.854	60.000	61.203
POND LEVEL		35.905	36.493	35.221	35.140	36.038	36.113	37.806		
EXST LEVEL	35.960	35.934		36.308	36.784	37.194	37.508	37.946	38.000	

REV.	DETAILS	DRAWN	CHECKED	DATE
.	.	.	.	.

STATUS:
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PROJECT:
Swanbridge Road, Sully

CLIENT:
Taylor Wimpey

DRAWING TITLE:
Indicative Pond Profile

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Broad Quay House, Prince Street, Bristol, BS1 4DJ
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