Technical design note

Project name	Parc Pelenna Holiday Resort		
Design note title	Drainage and Engineering Strategy		
Document reference	PEL-HYD-XX-XX-RP-C-0002		
Author	Johnathan Hamilton		
Revision	01		
Date	7 May 2024	Approved	✓

1. INTRODUCTION

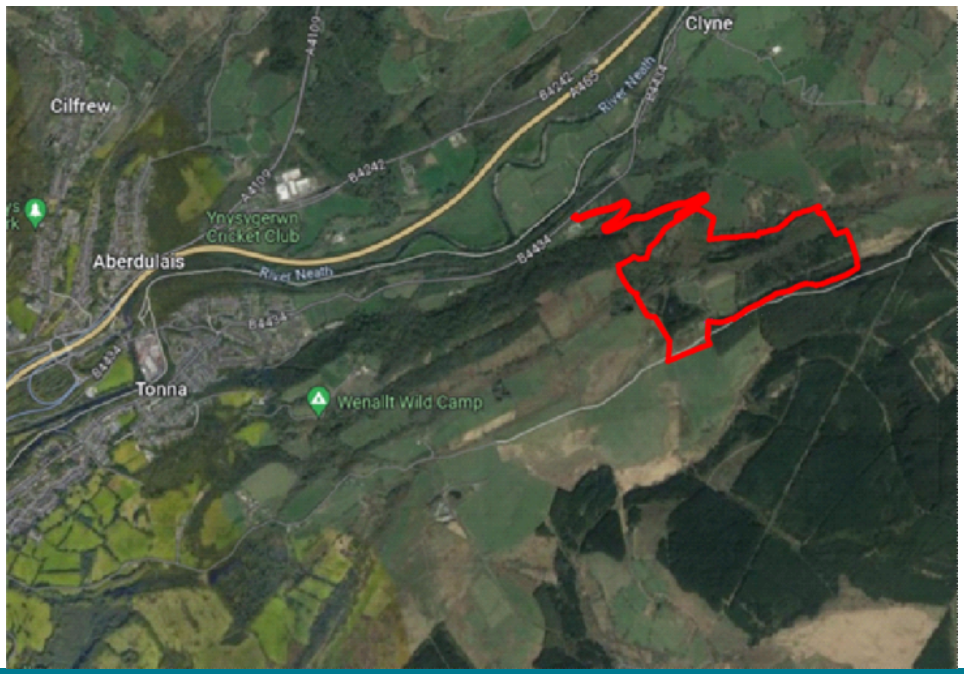
1.1 Purpose of report

Hydrock have been appointed by Trivselhus UK Holdings Limited to produce a robust drainage and engineering strategy for a proposed holiday resort in the Neath Valley in South Wales.

1.2 Existing topography

The site is located on the south side of the neath valley. The site address is Parc Pelenna Holiday Resort, Fairyland Road, Neath, Port Talbot, SA11 3QE. The existing site generally slopes steeply from south east (high) to north west (low). To the north of the site there is an existing public highway, the B4434 and to the south the Parc Pelenna woodland. The site location is indicated below in Figure 1;

Figure 1 - Site location - Google Earth, March 2024



UK OS grid reference - SS 801 995 - Centre of site coordinates - E-280170 N-199542

1.3 Existing drainage

According to Dwr Cymru Welsh Water (DCWW) historical records, the site is not served by local surface or foul water drainage infrastructure. There are existing watercourses in the form of overland streams, throughout the site. The approximate locations of these streams and their catchments are indicated on drawing PEL-HYD-XX-XX-SK-C-0011, presented in Appendix A.

These streams present an excellent opportunity to direct surface water flows from the development to the River Neath via existing watercourses, thus avoiding potentially significant infrastructure associated with a new outfall.

As part of the design development for the project, these watercourses will need to be fully surveyed and assessed. This assessment would take into account their condition, capacity, route, associated flood risk and the current catchment they serve. Furthermore, the Twrch Brook and its condition, capacity, route, associated flood risk and outfall to the River Neath would also need to be assessed. This assessment would require engagement with third party landowners, and Natural Resources Wales (NRW).

2. Surface water strategy

2.1 Introduction

The new development will require a surface water drainage system that is designed in accordance with Schedule 3 of the Flood and Water Management Act 2010 that came into effect in Wales on 7th January 2019. As such, all new developments where the proposed construction area is of 100m2 or more are required to implement Sustainable Drainage System (SuDS) to manage surface water. These measures must be designed and built-in accordance with mandatory standards for sustainable drainage published by Welsh Ministers. In addition to planning consent, these systems must be approved by the Local Authority acting in its SuDS Approving Body (SAB) role before construction work can begin.

A proposed concept drainage design drawing (PEL-HYD-XX-XX-SK-C-0010) has been prepared on this basis considering also the developments requirements and is included in Appendix B. The proposed system is to be designed to not flood for all events up to the critical 1 in 100-year rainfall event with an additional 40% allowance for climate change.

2.2 Sustainable Drainage Systems (SuDS)

The Sustainable Drainage Systems for Wales guidance sets out six standards (S1-S6) for the management of surface water runoff within a new development. In relation to this proposed development:

Standard S1 - Surface Water Runoff Destination

A new surface water drainage system will be required to serve the proposed building and hard surface areas. Available options considered in line with the discharge hierarchy may be summarised as follows (Table 1):

Table 1 - Surface water discharge options

	Destination Option	Means	Considerations
1.	Re-use	Collection, temporary storage and reuse (e.g. rainwater harvesting)	Rainwater harvesting could be provided on an on plot basis, with rainwater pipes collected into a tank under the driveway and pumped back into the plots to use for toilet flushing. As this will be the favoured approach by the approving body, the feasibility of this approach can be explored further in subsequent design stages.
2.	Ground	Infiltration SuDS techniques (e.g. basin)	No soakaway tests have been carried out to date, however due to the presence of significant holding water on the surface around the site it is not relied upon at this stage.
3.	Local watercourse	Conveyance via SuDS techniques (e.g. swale) or piped outfall	It is proposed that the development surface water will be discharged into the existing streams on site. The destination of surface water flows from the development will attempt to mimic the existing arrangement as much as practicable.

Standard S2 - Surface Water Runoff Hydraulic Control (Water Quantity)

It is proposed that surface water run-off from the development be divided into catchments that mimic the existing catchments as much as possible, with post development peak discharge rates restricted to the pre development Qbar greenfield rates, for all events up to the critical 1 in 100 +40% for climate change event.

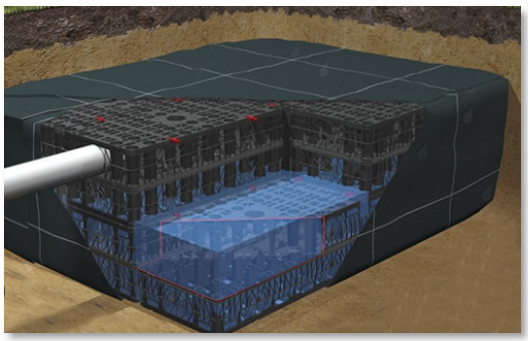
Due to the decentralised nature of the scheme with localised development parcels that avoid areas of existing woodland, excessively steep slopes and areas of ecological value, greenfield run-off calculations will be carried out on each development area per catchment. A number of flow control devices will be employed to restrict surface water flows to the post development peak discharge rates. below shows examples of flow controls;

Figure 2 - Controflow orifice control system (Left) can be used for smaller below shows examples of flow controls;

Figure 2 - Controflow orifice control system (Left) can be used for smaller discharges. Hydrobrake system (Right) for more significant discharges

Consequently, attenuation will be required in order to store excess surface water when the proposed maximum discharge rate is surpassed. Due to the steep gradients on site, forming basins/ponds downstream would be unfeasible, as such attenuation will take the form of localised wetlands, swales and below ground cellular storage crates, see Figure 3 below;

Figure 3 - Examples of wetlands (Left) and cellular crates (right)



Standard S3 - Water Quality

Surface water runoff should be treated to prevent negative impacts on the receiving water quality and/or protect downstream systems. In order to address the drainage design requirements in minimising the potential pollution risk posed by surface water runoff to a receiving water body. The proposed strategy will seek to include SuDS features which provide multiple benefits incorporating the facilities to treat the drained areas served in line with the SuDS Manual requirements.

The highest risk of contamination to runoff is presented by the car parking areas which is proposed to be managed by permeable surfacing and subsequently by swales and vegetated wetlands which will each provide treatment through percolation of surface water through soils/ filter media and or via interception and settlement. This treatment train will be developed in consultation with the SAB and detailed within the proposed drainage strategy for full planning and further design stages.

Standard S4 - Amenity

The design of SuDS components within the development will aim to enhance the provision of high quality, attractive landscape sympathetic to its surroundings. This can help provide health and wellbeing benefits to staff and visitors alike, and also contribute to improving the climate resilience of the development. In coordination with the Architect and Landscape Architect, an attractive external space is being developed that incorporates the proposed SuDS features suitable to the local environment.

Standard S5 - Biodiversity

The proposed drainage systems are proposed at surface level whenever possible, will be visible with vegetated components, and will form part of the local green infrastructure seeking to promote biodiversity which will be developed further through detailed design. The biodiversity of the receiving surface water drainage network will also be protected by the aforementioned water treatment measures offered by the SuDS measures chosen.

Standard S6 – Design of Drainage for Construction, Operation and Maintenance and Structural Integrity

All surface water drainage is to be designed and constructed in accordance with Sewer for Adoption 7th Edition, the CIRIA SuDS Manual C753 and CDM 2015 Regulations. Any risks associated with the surface water drainage system will be identified and sought to be designed out during the detailed design in line with best practice. Any residual risks associated with the design will then be assessed by the contractor who should seek to implement suitable control methods.

For surface water drainage systems to be managed privately by the site maintenance team, a maintenance plan must be set out and approved prior to the adoption of the system. It is anticipated that the on-plot private drainage systems and SuDS are to remain private. Similarly, the end user maintenance team will adopt the maintenance regime for the components/features they are responsible for post development.

2.3 SuDS features

Given the topography of the site, and the aforementioned constraints associated with regards to drainage and SuDS, an "at source" approach for the proposed hard landscaping, lodges and buildings likely represents the most cost effective solution to achieving SAB approval. The below methods have been preferred as they are in keeping with the rural feel of the development and will allow the development to be less impermeable in nature.

These "at source" and other measures for buildings and hard landscaping include:

For lodges and buildings:

» Rainwater harvesting for grey water use where appropriate usage levels can be employed

Figure 4 - Example of on-plot rainwater harvesting system

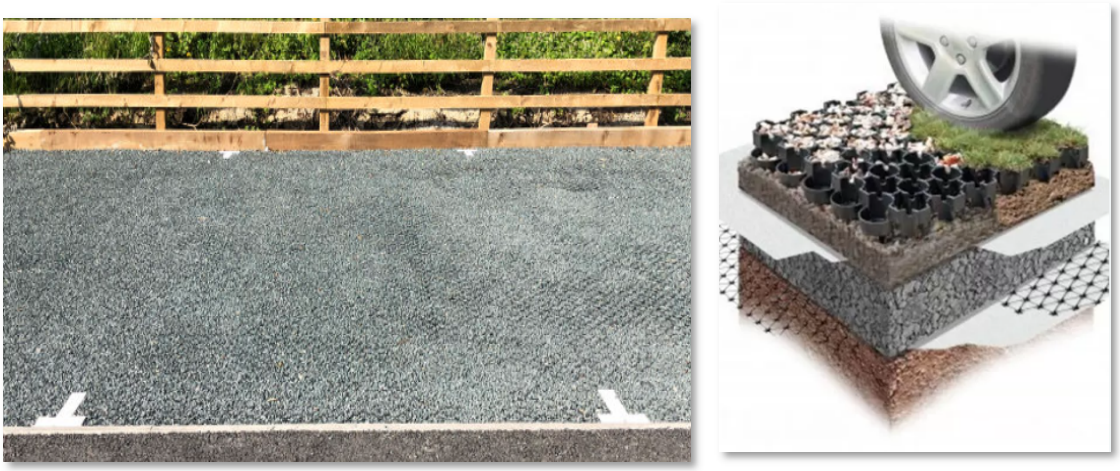
» Rural style swales, with baffles to convey and slow the flow of water

Figure 5 - Example of rural Swale

For hard landscaping (excluding roads)

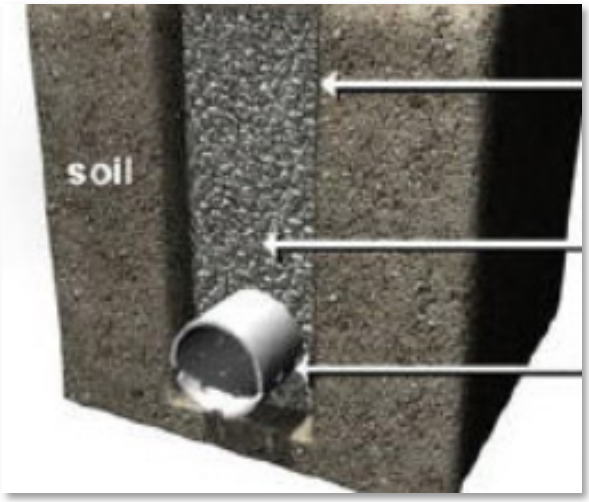
- Permeable under-drained grasscrete style surface to areas not impacted by topography (i.e. shallow slopes/driveways)

Figure 6 - Example of permeable paving system - Bodpave



- Perimeter SuDS channels (small swales and/or gravel strips) to areas not suitable for permeable paving

Figure 7 - Filter drain style SuDS channels



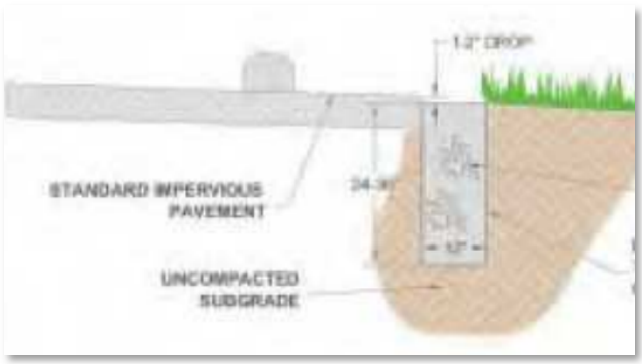
For roads

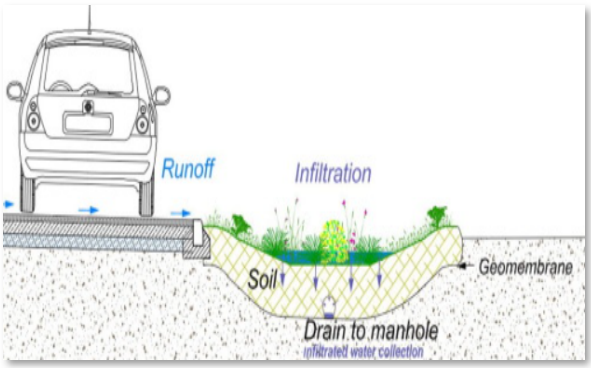
- Light vehicle roads - Impermeable tarmac wheel strips with permeable under-drained central grasscrete channels to areas impacted by topography (i.e. steep slopes)

Figure 8 - Example of grasscrete central strip road

- Heavier duty roads - Tarmacadam surface with filter strip or swale to the low side of the road, where surface water is allowed to drain freely overland into a filter strip or swale that runs parallel to the road.

Figure 9 - Road with filter strip (Left) and road with shallow swale (Right)





2.4 Land drainage

Due to the presence of standing water in some areas of the existing site, cut off land drains will be required in affected areas where there is potential to affect the proposed buildings. Such arrangements will only be provided locally to where buildings and roads may be affected so as to avoid draining existing areas of wetlands that house valuable ecosystems. Localised standing water was witnessed during a Hydrock site visit in January 2024. The land drain features will discharge directly into the existing watercourses and not through the proposed site surface water network.

2.5 Erosion protection/Ground stability

The Archaeological and Heritage Assessment (edp6556_r006a) has identified an area of the site that has record of mining with associated spoil in the West of the site, near where the Meander group of lodges are to be located. The LiDAR survey information shows evidence of this together with historical mapping data. In order to ensure that the development has no negative impact on the mobilisation of soils a number of design methods shall be adhered to;

- Surface water in effected areas of the site shall be dealt with via lined SuDS features, ensuring no additional run-off be allowed to permeate into the ground and cause erosion and instability of the existing spoil tip.
- Cut off land drains in the form of gravel drainage traps with impermeable membrane on the low side shall be utilised to intercept any surface water run-off that is generated by the development. Any flows generated will be discharged directly into the existing local watercourses.
- Soakaways will not be proposed in areas that are in the vicinity of historical mining and associated areas spoil.

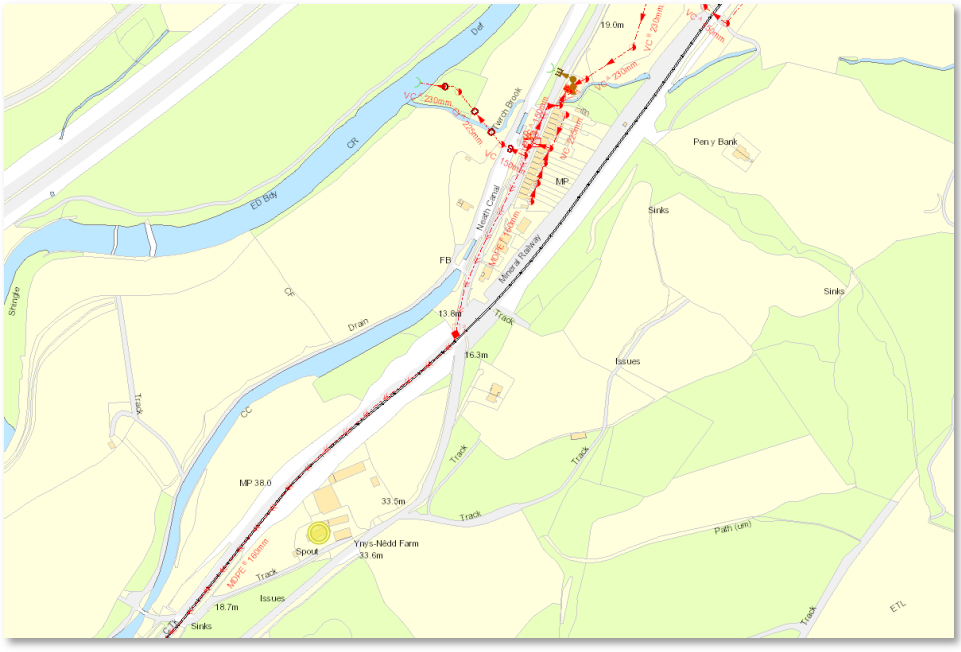
3. Foul water strategy

3.1 Existing public sewer network

According to DCWW historical records, the site is not served by a gravity foul or combined sewer. A foul pumped rising main is present within the B4434 within the local residential cluster, that then routes along the Mineral Railway heading south west. There appears to be two local pumping stations, as well as a valve position where it turns onto the alignment of the Mineral Railway. The network also includes two emergency overflow outfalls - one to the Neath Canal, and one to the River Neath.

This pumped infrastructure is part of a daisy chain of pumped and gravity mains that continue down the valley towards Neath. See extract from the DCWW records below in Figure 10.

Figure 10 - DCWW historical records, accessed March 2024



The existing pumped system could be checked for capacity via a Pre-Planning Advice application (PPA) with DCWW. However, even if there was capacity available within the system, the route to get to a point of connection would be extensive, with new infrastructure required to take foul flows from the bottom of the consented development access road, north east to the pumping station on the B4434 within the residential cluster. Indeed existing levels may dictate that this new length of infrastructure may also need to be pumped,

Costs, disruption and third party agreements associated with this proposal would be significant.

As an alternative, the foul flows from the development could be treated on site, via a wastewater sewerage treatment plant, with the treated water discharged into the existing watercourses. This proposal will require engagement with and agreement from NRW.

3.2 Foul options

There were two viable options for wastewater treatment facilities on site;

- Cluster treatment - the individual lodge clusters could be treated together, via a number of dedicated treatment plants, with discharges into the watercourses that flow through the site.
- Global treatment - the foul flows from the whole site could be routed via a traditional foul drainage system (within the road network) to a centralised treatment facility. The treated run-off from the facility could then be routed to outfall into an agreed watercourse.

3.3 Current foul water network proposals

It is considered that a centralised wastewater treatment facility be located at the lowest part of the site (ignoring the proposed access road from the B4434). The chosen area is located in the north of the site, with a dedicated access from the main spin road through the site. This method has been preferred for the following reasons;

- Single application to NRW to gain a permit to discharge
- Single centralised area for maintenance vehicles to access, such as tankers to carry out de-sludging and to aid any delivery of dosing chemicals required. This will allow local development access roads to be narrower and reduce the need to provide more hard surfacing than necessary within lodge areas.
- Avoids losing development areas around the site, freeing up space for lodges and reducing impact on existing areas of ecological value and woodland.

4. Levels Design

4.1 Existing Levels

Levels generally fall from approximately 250mAOD in the south to 140mAOD in the north of the development area. The access road from the B5535 is situated at approximately 40mAOD and ends within the development area of the site at 140mAOD, The steepness of the site varies significantly across the site with several groupings of trees and woodland. There are also sensitive habitats that should be integrated into the design.

4.2 Proposed levels

The design principles that were utilised to produce the current road designs area;

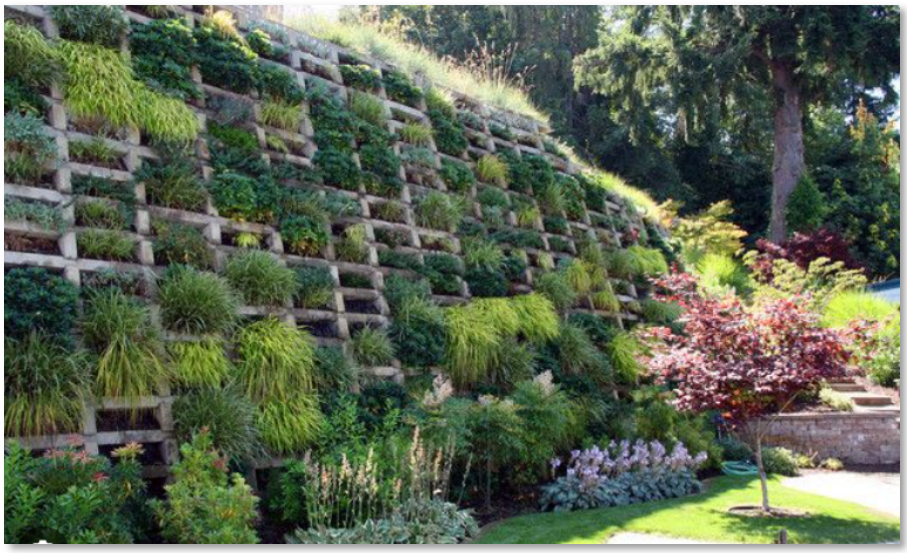
- Target maximum gradient for the road network - 1 in 12 (8.33%)
- Only relaxation required is a single section of road 2 to be 1 in 8 (12.5%) in order to achieve existing tie ins and avoid existing woodland.

- Embankments to be 1 in 1, to minimise the footprint of tie ins from the road to the existing levels. Note that these will require geotechnical input and potential ground reinforcement to ensure stability.
- Alignment chosen follows a more gradual natural gradient up the side of the valley and avoid existing areas of trees as much as possible.
- During design development of the proposed road alignment, great care was taken to minimise the impact of the roads and associated embankments on adjacent trees and sensitive habitats.

With regards to the access to proposed lodges the following design philosophy was followed;

- Where lodges are to be sited on existing steep gradients, an integrated retaining wall will be provided in a split level building, with access from the proposed highway to the high side of the lodges.
- Where existing levels dictate, some external retaining walls will be required to allow the formation of SuDS features and/or to meet tie in levels. It is proposed that crib walls would be most sympathetic to the nature of the development and should be a cost effective solution. Examples of this type of wall can be planted to be in keeping with the rural surroundings.

Figure 11 - Example of crib retaining wall



Notwithstanding the above there are still some key issues that will need consideration during the design process going forward;

- Temporary slope stability - the stability of existing slopes will need to be assessed in the temporary case to enable construction of roads, paths, lodges, utilities and drainage infrastructure and other buildings.
- Permanent slope stability - in conjunction with foundation, hard and soft landscaping design, the existing, modified and proposed slopes will need to be assessed for the final condition of the site.
- Building Foundations - the design, and more pertinently, buildability of foundations on such steep slopes will need to be considered following the completion of ground investigations. It is possible that the foundation solution for lodges may dictate specialist systems, and contractors for foundation works.
- SuDS - SuDS features will need to be carefully designed so as to not adversely impact ground stability. Any open features, watercourse extensions, rills etc will need to consider downstream baffling on significant gradients to mitigate potential erosion in extreme weather events.

- Ecology - construction operations will need to planned so as to respect and mitigate effects on existing ecology. Of particular note will be the need to assess the temporary conditions of the construction phase, where ground disturbance may involve significantly larger areas than the final building and infrastructure plots due to the effects of slopes.
- Construction - the construction phase will need to be carefully planned around the existing topography, with a phased build that allows construction access, and also phased protection of the constraints and proposed buildings, roads, paths and infrastructure.

Appendix A Existing catchments plan

Line of existing part formed access road through zone of ancient woodland is as per planning permission ref 2017-0628 dated 20.08.17

Line of existing part formed access road through zone of ancient woodland is as per planning permission ref 2017-0628 dated 20.08.17

OS NORTH

The Clearing

The Spur

The Lookout

The Hub

The Ponds

The Meander

The Village Green

The Meadows

NB. zone of ancient woodland within site was recently a coniferous woodland and was previously clear felled under license.

KEY

- RED CATCHMENT
- GREEN CATCHMENT
- BLUE CATCHMENT
- YELLOW CATCHMENT
- PURPLE CATCHMENT
- ASSUMED WATERCOURSE - NOT IDENTIFIED ON SITE
- IDENTIFIED WATERCOURSE - APPROX. LOCATION
- STANDING WATER FEEDING INTO WATERCOURSE
- SURFACE WATER FLOW PATH DIRECTION

APPROXIMATE LIDAR SURVEY INFORMATION UTILISED TO FACILITATE ASSESSMENT - FULL TOPOGRAPHICAL 3D SURVEY REQUIRED TO PROGRESS DESIGN

KEY PLAN

NOTES

Rev	Date	Description	By	Chd	App
P05	20/01/24	Client and project name changed	JS	RB	MA
P02	26/02/24	Layout updated	JS	RB	MA
P01	08/02/24	First Issue	JS	RB	MA

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CLIENT
TRIVSELHUS UK HOLDINGS LIMITED

PROJECT
PARC PELENNA HOLIDAY RESORT

TITLE
DRAINAGE CATCHMENT ASSESSMENT

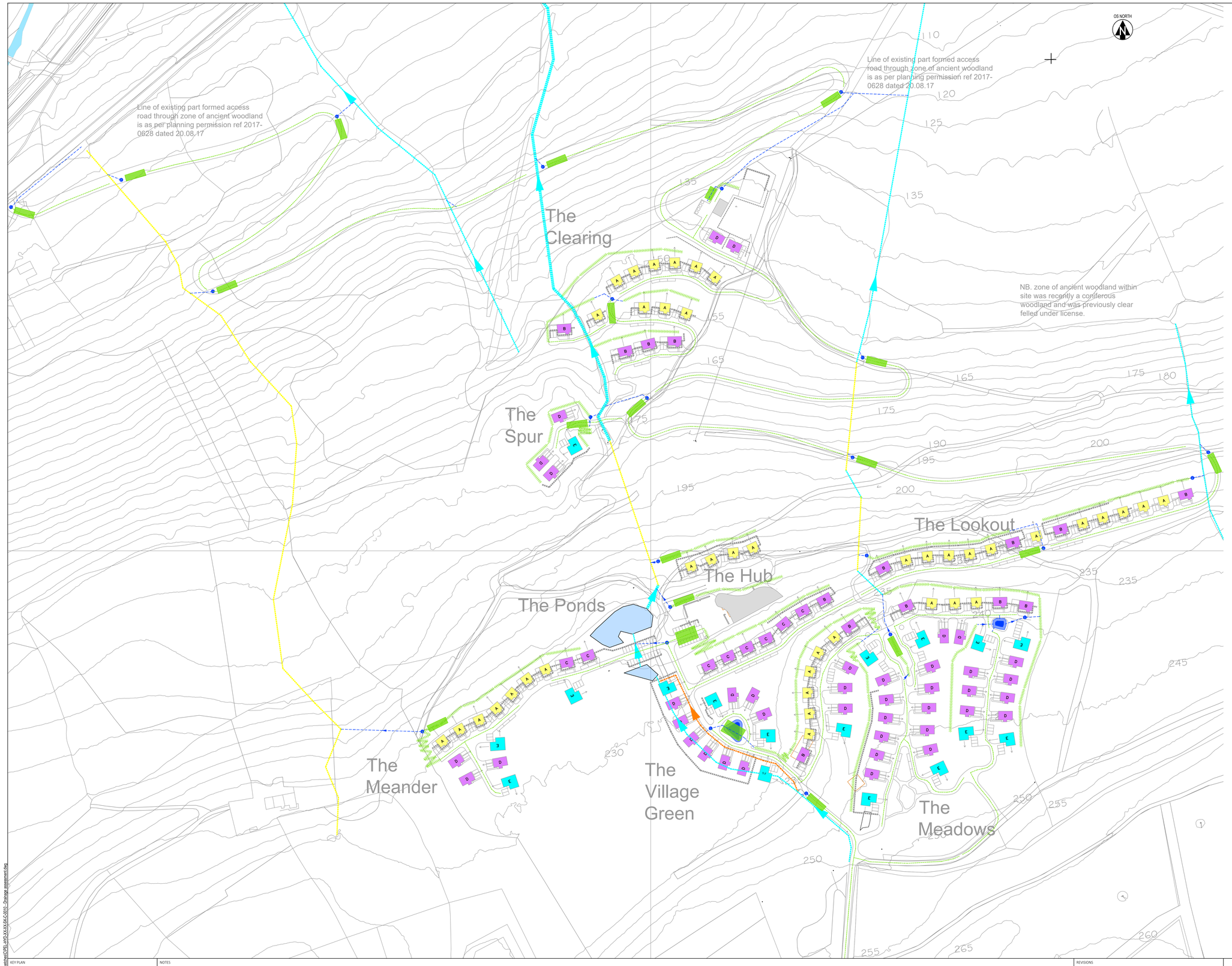
HYDROCK PROJECT NO.	SCALE @ A0
C-07546	1:1000

STATUS DESCRIPTION	STATUS
FOR INFORMATION	S2

DRAWING NO. (PROJECT-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)	REVISION
PEL-HYD-XX-XX-SK-C-0011	P03

Filename: Y:\16000-16999\16944 - Parc Pelennol\01_WIP\5K_Sketches\CP\EL-HYD-XX-XX-SK-C-0011 - Existing catchments.dwg

Appendix B SuDS strategy



KEY

- ASSUMED WATERCOURSE - NOT IDENTIFIED ON SITE
- IDENTIFIED WATERCOURSE - APPROX. LOCATION
- SURFACE WATER SEWER - MAIN LINES ONLY
- ROAD FILTER DRAIN
- INDICATIVE VARIABLE WIDTH SWALE
- APPROX. LOCATION OF FLOW CONTROL CHAMBER
- INDICATIVE CELLULAR ATTENUATION - SIZE TO BE CONFIRMED - LIKELY SMALLER THAN SHOWN
- INDICATIVE POND - SIZE TO BE CONFIRMED SUBJECT TO LEVELS
- EXISTING SWALE DIVERSION

APPROXIMATE LIDAR SURVEY INFORMATION UTILISED TO FACILITATE ASSESSMENT - FULL TOPOGRAPHICAL 3D SURVEY REQUIRED TO PROGRESS DESIGN

KEY PLAN

NOTES

REVISIONS

Rev	Date	Description	By	Ckd	App
P05	20/02/24	Client and project name changed	JB	RB	MA
P04	13/02/24	Revised for layout update	JB	RB	MA
P03	26/02/24	Layout updated	JB	RB	MA
P02	09/02/24	Outline SuDS indicated	JB	RB	MA
P01	23/01/24	First issue	JB	RB	MA

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PROJECT
PARC PELENNA HOLIDAY RESORT

TITLE
SUDS ASSESSMENT

HYDROCK PROJECT NO.
C-07546

SCALE @ A0
1:1000

STATUS DESCRIPTION
FOR INFORMATION

STATUS
S2

DRAWING NO. (PROJECT-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)
PEL-HYD-XX-XX-SK-C-0010

REVISION
P05

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