CAMBRIA Constructive Thinking

Report Title

FLOOD CONSEQUENCE ASSESSMENT (FCA) & DRAINAGE STRATEGY

Project

UPPER COSMESTON FARM

Report Reference

CC1857-CAM-ZZ-XX-RP-C-00-0001

Client

AUSTIN SMITH LORD
WELSH GOVERNMENT

Date

SEPTEMBER 2020

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REPORT CONTROL SHEET

Client:	Austin Smith Lord / Welsh Government
Project:	Upper Cosmeston Farm
Job Number:	CC1857
Report Title:	Flood Consequence Assessment (FCA) & Drainage Strategy
Report Reference:	CC1857-CAM-ZZ-XX-RP-C-00-0001
Prepared By:	C Parker
Reviewed and Authorised By:	B Whyman

Revision	Date	Description	Prepared By	Authorised By
P01	06/19	First Issue	C Parker	B Whyman
P02	08/19	Second Issue	C Parker	B Whyman
P03	08/19	Third Issue	C Parker	B Whyman
P04	09/20	Figure 4.1 and Appendix B updated	C Parker	B Whyman

Contents

0 INTRODUCTION

0.1 Cambria Consulting Ltd have been commissioned by Austin Smith Lord on behalf of the Welsh Government to provide a Flood Consequence Assessment and Drainage Strategy Report in support of a master planning exercise and outline planning application for 576 new residential dwellings and associated infrastructure located at Upper Cosmeston Farm, Vale of Glamorgan.

0.2 Zones of flood risk across Wales have been identified through Development Advice Maps (DAMs) included with the Technical Advice Note (TAN) 15: Development and Flood Risk guidelines published in July 2004. Updated DAMs were issued in 2009 and more recently a larger scale interactive version has become available on the Welsh Government's website with data revised as recently as January 2015. Flood risk maps are also available on the Natural Resources Wales (NRW) website. These maps are still under development and detail flood risk from main rivers, sea, surface water and reservoirs. NRW's latest interactive map shows the site lying primarily within Zone A with some of the site falling into Zone B. Zone A is defined as being at little or no risk of fluvial or tidal/coastal flooding. Zone B are areas known to have flooded in the past evidenced by sedimentary deposits

0.3 Given the classification, the primary driver for this report is to ensure the proposed development is suitable to the location and whether suitable measures can be incorporated to ensure that the development is as safe as possible. The report will also ensure an effective surface water management strategy is implemented and disposal is achieved without adverse flood risk impacts. This is aligned to the objectives of the Welsh Government's Planning Policy Wales, Edition 10, December 2016.

0.4 This FCA follows the numbering of seventeen points listed in paragraph A1.17 of TAN 15 Appendix 1 with relevant information on the development site and its setting described under the appropriate headings.

0.5 At this stage, proposals are largely limited to 'planning' level. This FCA is therefore commensurate with this level of detail and seeks to establish the principles of mitigation to be integrated into the detailed design of the scheme.

0.6 This report has been informed by desk study observations, a site walkover, NRW's flood mapping service, an Envirocheck Report obtained from Landmark Information Services, in support of Cambria's own assessment of the fluvial and pluvial flood risks and groundwater flood susceptibility of the area.

1 SITE LOCATION

1.1 The development site is located at Upper Cosmeston Farm, Lavernock Road.

1.2 The site is approximately 25.2ha and a mixture of greenfield land comprising fields that make up winter paddocks and associated with the livery, historic former quarry used as summer paddocks, historic former quarries and landfill and fields used for crop growth. A former railway embankment runs through the central portion of the site. The site is bounded by residential development to the north, Lavernock Road to the west, fields to the south and the coastline to the east.

1.3 The site is centred around OS coordinates E: 318280, N: 169157 see in Figure 1.1 below;

1.4 A more detailed site location plan is included in **Appendix A**.

Figure 1.1 - Location Plan
Source: Google Earth

1.5 The Development Advice Maps (DAM) show the majority of the site is in Zone A with some of the area falling into Zone B. Zone A is defined as being at little or no risk of fluvial or tidal/coastal flooding. Zone B are areas known to have flooded in the past evidenced by sedimentary deposits. An extract of the DAM map is shown in Figure 1.2 below;

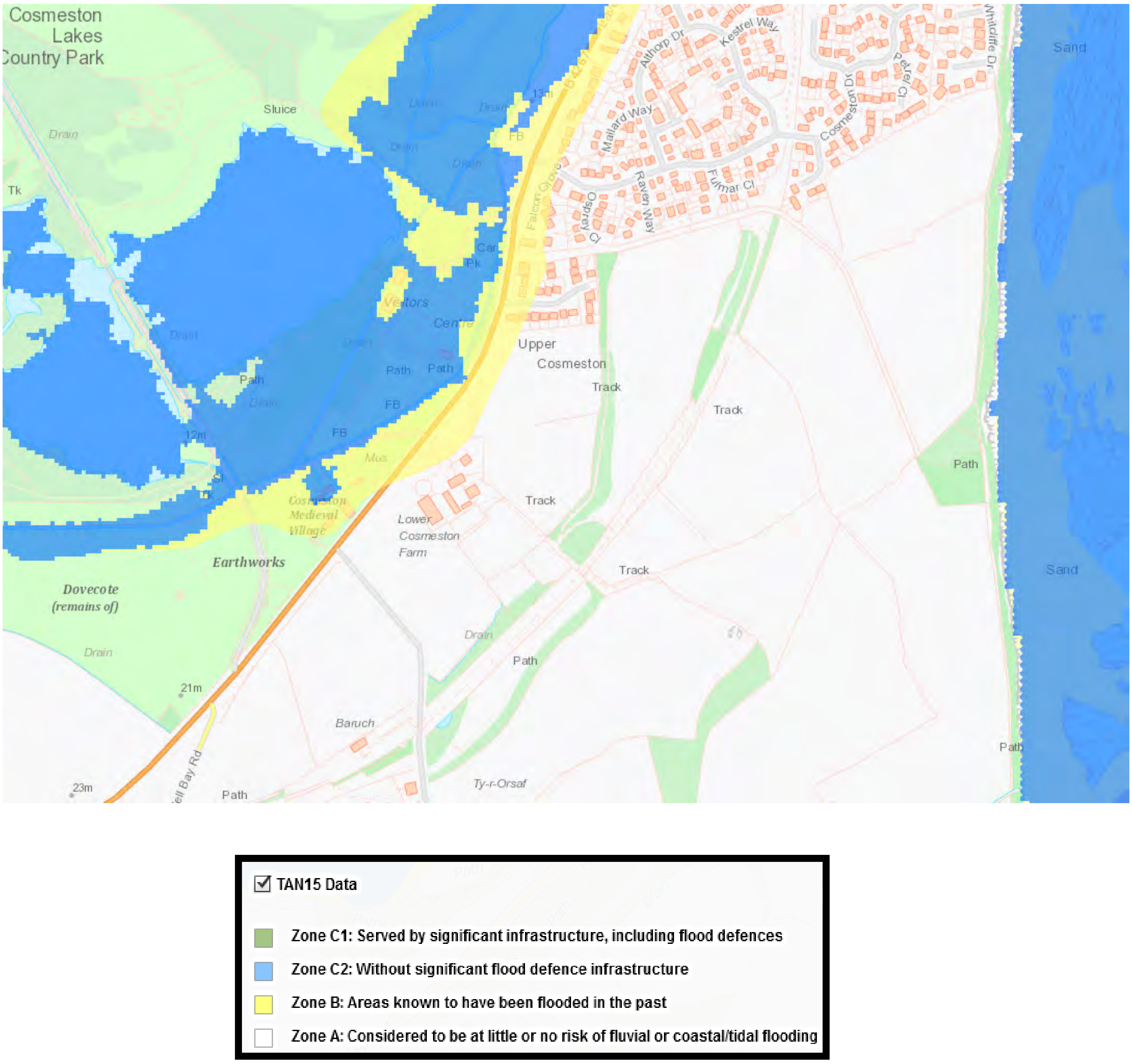


Figure 1.2 – Flood Risk Zone

Source: Natural Resources Wales, DAMs

1.6 The development type would be considered residential premises and therefore is classified as a **'highly vulnerable development'** within TAN 15. TAN 15 aims to direct development towards sites within Zone A. As the site is situated predominantly in Flood Zone A, partially in Zone B and away from Zone C, it concurs with the aims of TAN 15 and no further justification is required.

Main Rivers and Ordinary Watercourses

1.7 The NRW Mapping data, shown on Figure 1.3, shows the site is in close proximity to Sully Brook, which is indicated as a main river.

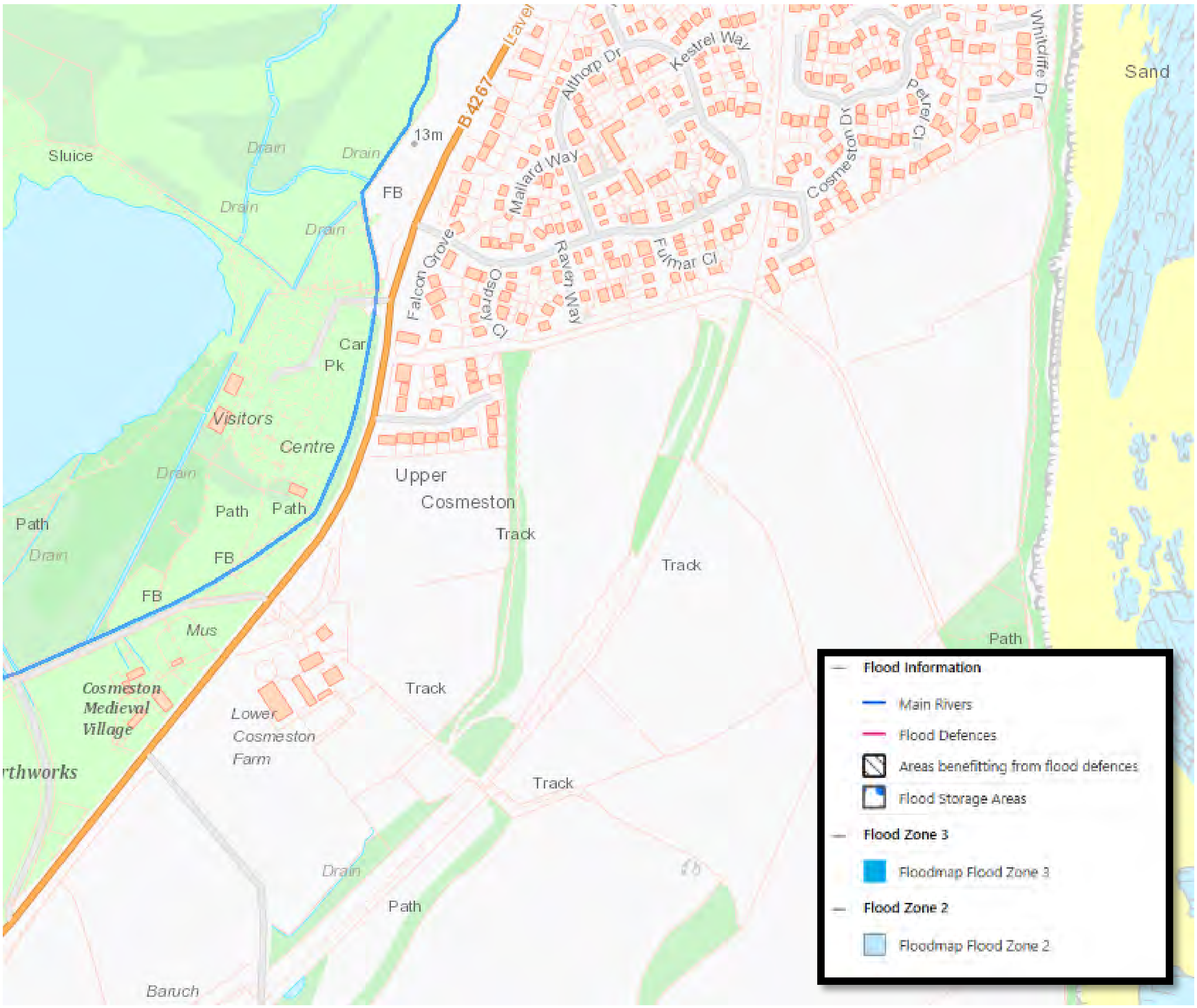


Figure 1.3 – Main River
Source: Natural Resources Wales, Flood Risk Map

2 EXISTING TOPOGRAPHY

2.1 A topographical survey of the site has been provided, a copy of the survey drawing is included within **Appendix C**.

2.2 The site generally falls from east to west. The highest point on the site is approx. 36.30mAOD and the lowest point approx. 12.50m AOD. There are two distinct level changes at the points where linear features dissect the site.

3 EXISTING FLOOD ALLEVIATION MEASURES

3.1 The closest flood defence measures are to the north of the site at Penarth Promenade and the Cardiff Bay Barrage.

4 DEVELOPMENT PROPOSALS

4.1 The proposed site layout plan, drawing number 318054 0930 produced by Austin Smith Lord is included in **Appendix B** and an extract of the layout is shown in Figure 4.1 below

Figure 4.1 – Proposed Site Plan
Source: Austin Smith Lord (ref: UFC-ASL-00-00-DR-A-0930)

4.2 Development proposals include the following;

- 576 Residential Dwellings
- Community Facilities
- Primary School

- Public Open Spaces
- Extension of NCN88 through the site
- New Roads, Footways and Cycleways
- SuDs Infrastructure and Landscaping.

5 ACCESS AND EVACUATION ROUTES

5.1 Vehicular access to the site will be provided via Lavernock Road.

5.2 Pedestrian access will be via Lavernock Road, connecting footpaths from the residential development to the north, the existing coastal path and the extended NCN88 cycle route.

5.3 The site is to be served by two access points off Lavernock Road adjacent the west boundary of the site. At the site entrances Lavernock Road has an elevation of 12.40m AOD at the south entrance and 12.65m AOD at the north entrance. Both entrances are at the low end of the site.

5.4 Should flooding occur as a result of local infrastructure failure / blockage, any resultant overland flows would be channelled along Lavernock Road and collect at localised low points along the highway in the vicinity of the proposed southern access.

5.5 Means of escape and emergency access should also consider the wider highway network and the potential impact of zones of higher flood risk to disrupt infrastructure connectivity. With reference to Figure 5.1, While part Lavernock Road is indicated to be affected by extreme events (Zone B) the wider network to the north of the site is unaffected. There are also legal rights in place to connect to Whitcliffe Drive which could be used as a link for an emergency route if necessary. Preferred routes will therefore be accessible during extreme events.

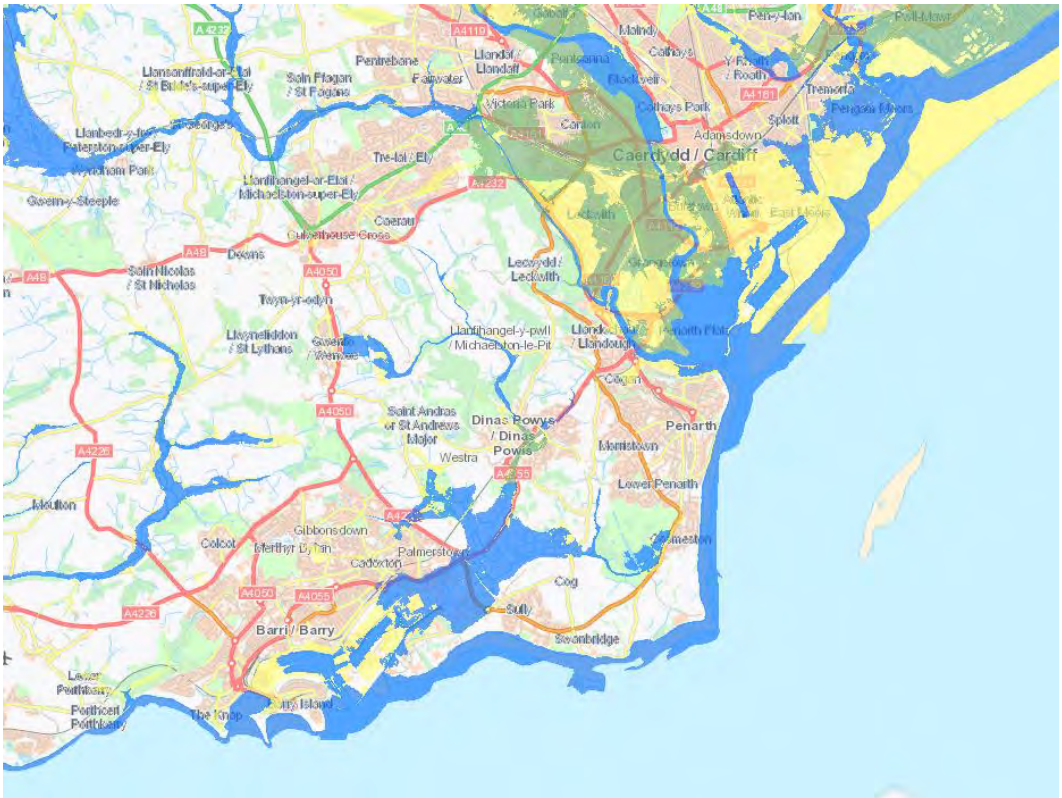


Figure 5.1 – Wider Area Flood Zones

Source: Welsh Government, TAN15 DAMs

6 POTENTIAL FLOODING SOURCES

Fluvial

6.1 The development site is situated predominantly in Flood Zone A, Little or no risk of flooding, with part of the site adjacent Lavernock Road located in Zone B of the DAM maps, areas known to have flooded in the past.

Pluvial

6.2 Welsh Water Dwr Cymru (DCWW) sewerage records, shown in figure 6.1 below, show there is a 4000mm x 3880mm combined brick sewer running south west just within the southern boundary of the site. The records also show a water main in the track that runs along the north boundary then into the top field. A site constraints plan is shown in **Appendix G.**

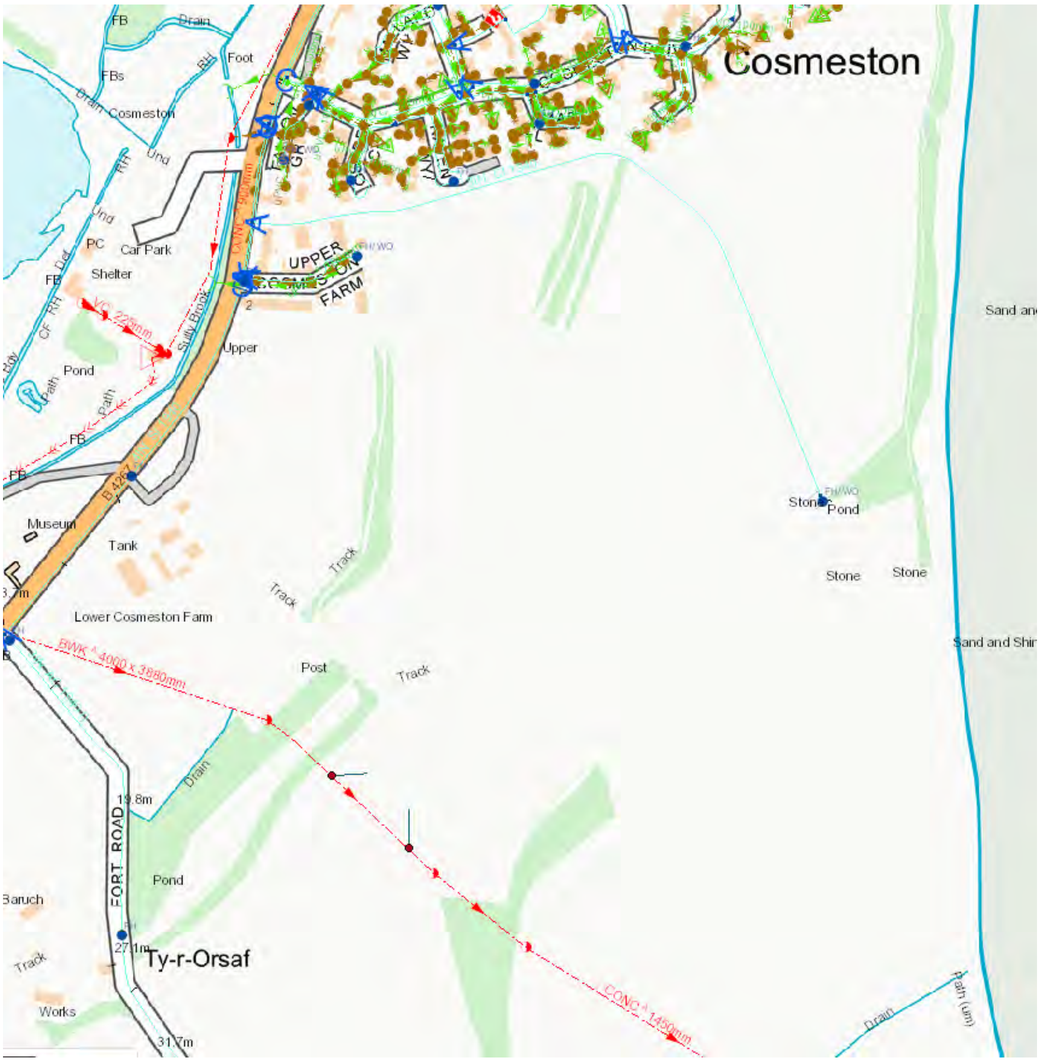


Figure 6.1 – Public Sewer Records

Source: DCWW Record Plan

6.3 There is a risk of pluvial flooding from any drainage network given a susceptibility to surcharge as a result of overloading / insufficient capacity which would be exacerbated during extreme rainfall events, infrastructure failure or blockage. Low lying areas on the network, upstream of a blockage / throttle point, are most vulnerable to the effect of "popped" access covers / gratings where surcharged waters escape the network. In this scenario, escaped flood waters would spread from the source, directed / channelled by kerbs and other physical features and either re-enter the system or locally pond on the surface in low spots or in areas where flow paths are restricted.

6.4 The topography of the surrounding area would suggest that the site is not vulnerable to inundation from overland flows as it is higher than the surrounding area, as previously mentioned any overland flows from existing pluvial sources would be directed to and channelled along the existing highway network to Lavernock Road.

Groundwater

6.5 Intrusive site investigation did not identify groundwater bodies, however further investigation and monitoring will confirm the level of groundwater flooding.

Reservoir

6.6 NRW mapping shows there is no risk to the site from Reservoir flooding.

7 FLOOD HISTORY

7.1 Natural Resource Wales DAM indicates the site is primarily in Zone A, areas at little or no flood risk. Part of development site is located within Zone B, an “area known to have flooded in the past evidenced by sedimentary deposits”.

Figure 7.1 – Historic Flood Mapping
Source: Welsh Government, TAN15 DAMs

8 STRUCTURES INFLUENCING FLOW

8.1 The main river, Sully Brook runs adjacent to the site.

8.2 Structures within the proposed drainage network such as headwalls and outlet flow controls are particularly vulnerable to blockage. A regular inspection and maintenance regime should be incorporated to ensure debris build up is removed and de-silting is undertaken as required to ensure continual optimal flow conditions and hydraulic performance.

8.3 An overflow facilty should be provided in any flow control chambers to allow for future blockages. Any headwall structures should respect the accepting channel section, and consideration should be given to requirements for trash or security screens.

9 PROBABILITY OF FLOODING

Fluvial Flooding

9.1 The NRW flood mapping information shown in Figure 9.1 below confirms the site is at little or no risk of fluvial/coastal flooding.

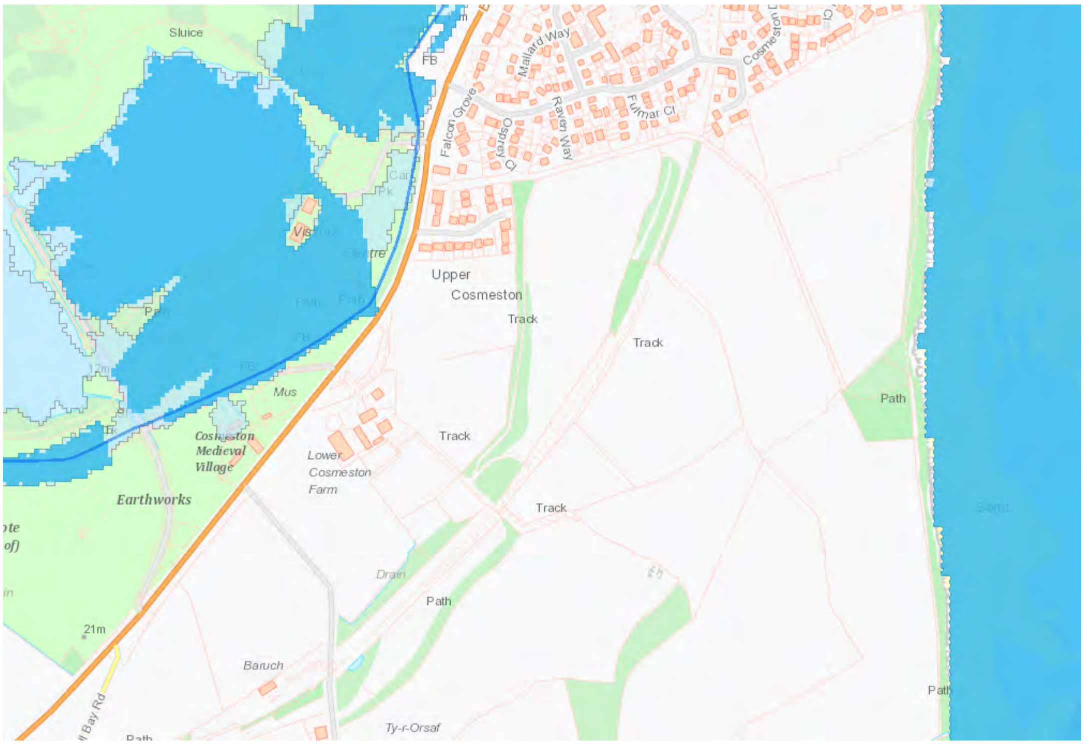


Figure 9.1 – Current NRW Flood Map

Source: Natural Resources Wales

Pluvial Flooding

9.2 The NRW mapping data, shown in Figure 9.2 overleaf, shows the risk of flooding from Surface Water. The classifications indicate the annual event probability in the following designations;

- Very low – less than 1 in 1000 (0.1%)
- “Low” – between 1 in 1000 (0.1%) and 1 in 100 (1%) – Coloured yellow
- “Medium” – between 1 in 100 (1%) and 1 in 30 (3.3%) – Coloured orange
- “High” – greater than 1 in 30 (3.3%) – Coloured dark orange

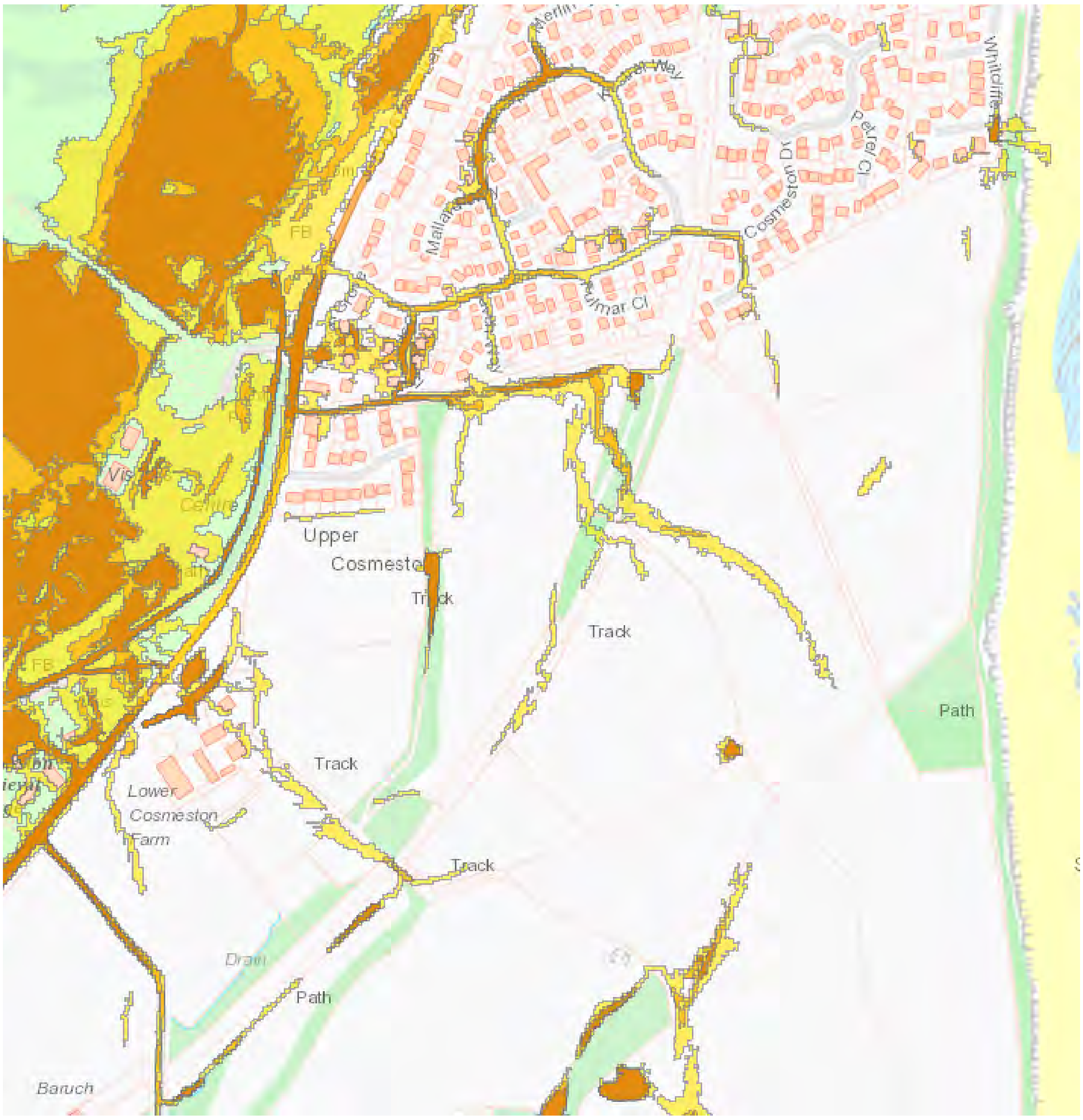


Figure 9.3 – NRW Risk of Flooding from Surface Water
Source: Natural Resources Wales Website – Flood Risk Map

9.3 Pockets of low, medium and high-risk areas of flooding does do exist on the site.

9.4 Vale of Glamorgan SAB response does mention the area of high flood risk situated around Whitcliffe Drive and confirms a historic incident of surface water flooding in 2013.

9.5 The proposed drainage infrastructure serving the new development will be designed in accordance with current standards, discussed further in Section 12, which typically requires retention of 1 in 100 year (1%) critical storm event flows. Exceedance events beyond this should also be considered and flow paths identified to ensure any overland flows are directed to less sensitive / designated areas mitigating risk of damage to persons and property and ensuring means of access and egress are not compromised.

Groundwater Flooding

9.6 A site investigation will be undertaken to establish the exact groundwater levels underlying the site. As part of the site investigation groundwater monitoring shows ground water levels at a minimum of 1.2m below ground level *(refer to ESP report ref:ESP.7061b.3215 Preliminary Controlled Water Risk Assessment).*

9.7 Groundwater levels are subject to seasonal variations and as such the design of the site should allow for shallow groundwater levels.

9.8 The current evidence suggests there is a low risk of groundwater flooding within the site.

10 PROPOSED DEVELOPMENT LEVELS

10.1 The proposed external levels design will ensure local grading mitigate the effects and impact of flooding. Falls away from building thresholds will be sought. Levels and physical features such as kerb lines will be used to channel and direct flow paths to lower lying, less sensitive / designated overflow areas without compromising routes of access or egress. The potential impact of ponding within any low-lying areas will be evaluated and if necessary mitigated against.

10.2 The specific proposed drainage infrastructure design requirements are discussed within Section 12. Through the introduction of restricted discharge rates, SUDS, attenuation measures and retaining excess flows within the site boundary, the proposed development will demonstrate no adverse impact on flood risk to downstream / neighbouring properties.

10.3 An effective design solution will consider drainage performance in conjunction with external level proposals.

11 IMPACT OF FLOODING

Fluvial Flooding

11.1 According to NRW data there is a **low risk** of fluvial flooding on the site.

11.2 The development therefore is deemed acceptable and no further justifcation based on flood risk criteria is required.

Pluvial Flooding

11.3 There are isolated pockets of **low, meduim and high risk** from surface water flooding in certain areas of the site.

11.4 If surface water flooding was to occur, then the design proposals would mitigate against exceedance flows whether the flows emanate from existing or proposed drainage features.

Groundwater Flooding

11.5 As discussed in section 9.3, there is likely to be a **low risk** from groundwater flooding to the the site. Further site investigation works will confirm the groundwater flooding risk.

11.6 The risk of groundwater flooding can be reduced and managed by ensuring design levels avoid lowering parts of the site significantly and also ensuring surface water storage structures or soakaways are designed at shallow depths.

12 DRAINAGE IMPLICATIONS

Existing Drainage

12.1 Welsh water record plans indicate a combined brick sewer running through the south west corner of the site.

Proposed Drainage

12.2 Separate foul and surface water drainage networks are to be provided. The proposed design will be undertaken in accordance with The Statutory Standards for Sustainable Drainage Systems, Sewers for Adoption 7th Edition, Building Regulations - Document H, CIRIA's C753 The SuDS Manual as appropriate.

12.3 The SuDS design will be subject to SAB approval.

12.4 The preliminary SuDS strategy is illustrated in drainage layout drawings CC1857-CAM-ZZ-XX-SK-C-90-0125 contained within **Appendix D**.

Foul water

12.5 The proposed foul drainage solution will be via a standard gravity piped solution connecting to the existing 900mm diameter combined sewer running though Cosmeston Lakes adjacent Lavernock Road.

12.6 A Section 104 application will be required to communicate the proposed foul flows to the existing network.

12.7 Welsh Water have confirmed that the existing network has capacity for the proposed 576 dwellings.

Surface Water

12.8 In October 2018, Welsh Government published the 'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining Surface Water Drainage Systems'. This standard is now mandatory for new developments with either a construction area greater than 100m² or more than 1 dwelling.

12.9 The principles which underpin the design of surface water management schemes to meet the Standards are as follows;

SuDS schemes should aim to;

- Manage water on or close to the surface and as close to the source of the runoff as possible;
- Treat rainfall as a valuable natural resource
- Ensure pollution is prevented at source, rather than relying on the drainage system to treat or intercept it;

- Manage rainfall to help protect people from increased flood risk, and the environment from morphological and associated ecological damage resulting from changes in flow rates, patterns and sediment movement caused by the development;
- Take account of likely future pressures on flood risk, the environment and water resources such as climate change and urban creep;
- Use the SuDS Management Train, using drainage components in series across a site to achieve a robust surface water management system (rather than using a single “end of pipe” feature, such as a pond, the serve the whole development);
- Maximise the delivery of benefits for amenity and biodiversity;
- Seek to make the best use of available land through multifunctional usage of public spaces and the public realm;
- Perform safely, reliably and effectively over the design life of the development taking into account the need for reasonable levels of maintenance;
- Avoid the need for pumping where possible; and
- Be affordable, taking into account both construction and long-term maintenance costs and the additional environmental and social benefits afforded by the system.

12.10 There are six mandatory standards to be achieved within the National SuDS standards, S1-S6. The following sections demonstrate compliance with each of these standards.

Standard S1 – Surface Water Run-off Destination

12.11 This standard reviews the disposal routes for surface water run-off. The destinations are split into 5 levels with level 1 being the most preferential and level 5 being the least preferred and only used in exceptional circumstances.

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

12.12 The feasibility of utilising rainwater harvesting collection systems will be looked at.

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

12.13 Infiltration testing has been undertaken. Additional infiltration testing is to be undertaken in accordance with comments from SAB. Where possible infiltration methods of drainage will be utilised in the SuDS design.

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

The nearest surface water body to the development is Sully Brook. It is proposed to discharge to Sully Brook at a restricted rate. The SAB comments received from Vale of Glamorgan Drainage Team have confirmed acceptance of the philosophy of a restricted rate to Sully Brook. A restricted discharge rate of 127.99 l/s will have to be agreed by SAB. NRW have been contacted regarding a Flood Risk Activity Permit (FRAP), there response is contained in **Appendix H**.

Standard S2 – Surface Water runoff hydraulic control

Greenfield Run-off Rates

12.14 The Greenfield Runoff rate for the proposed site has been calculated using the FEH method. The Greenfield run-off calculations are included in **Appendix E**. The FEH method gives a QMED value of 1430.2 l/s which had been linearly interpolated for the site area to 127.99 l/s.

12.15 Attenuation volumes for the proposed impermeable areas have been calculated using the Source Control tool within Microdrainage. The site has been broken down to 4 catchment areas and a pro rata discharge rate has been applied. The calculations are included in **Appendix F**. A summary of the attenuation requirements are shown in Table 12.3 below.

Table 12.3 – Attenuation Storage Volumes

Total Impermeable Area = 14.75 ha **Restricted discharge rate = 127.99 l/s**	
Catchment Area	**Attenuation Volume Requirement 1 in 100yr Return Period +30% Climate Change Allowance (m^3)**
Catchment Area A Imp Area = 4.10 ha Pro Rata Discharge Rate = 35.55 l/s	2882
Catchment Area B Imp Area = 3.31 ha Pro Rata Discharge Rate = 28.73 l/s	2324
Catchment Area C Imp Area = 4.33 ha Pro Rata Discharge Rate = 37.62 l/s	3209
Catchment Area D Imp Area = 3.01 ha Pro Rate Discharge Rate = 26.09 l/s	1461 *(Infiltration potential has been included as part of this attenuation calculation)*

The general principles of the SuDS strategy for the site are shown on drawing CC1918-CAM-ZZ-00-DR-C-52-1101 within **Appendix D** along with the Vale of Glamorgan's SuDS Approval Body comments.

Interception of run-off

12.16 Interception mechanisms will be required to ensure compliance with the requirement of zero runoff for the first 5mm rainfall for 80% of storm events during the summer and 50% in winter.

12.17 With reference to Table G2.1 'Interception mechanisms with assumed compliance' of the National SuDS standard interception mechanisms will be achieved through the use of infiltration structures, permeable paving, swales, rain gardens, bioretention areas, detention basins and ponds.

Standard S3 – Water Quality

12.19 SuDS shall be utilised wherever possible and designed in accordance with the Nation SuDS Standards and The SuDs Manual. Table 12.4 below identifies suitable SuDs techniques that would be appropriate for the development;

Table 12.4 – Indicative Suitability of SuDs Components within the Management Train

SuDs Component	**Interception**	**Close to Source/Primary Treatment**	**Secondary Treatment**	**Tertiary Treatment**	**Site Suitability**
Rainwater Harvesting	Y				✓
Filter Strip	Y	Y			✓
Swale	Y	Y	Y		✓
Filter Trench	Y		Y		✓
Permeable pavement	Y	Y			✓
Bioretention	Y	Y	Y		✓
Green Roof	Y	Y			×
Detention Basin	Y	Y	Y		✓
Pond		Y	Y	Y	✓
Wetland		Y	Y	Y	✓
Infiltration System	Y	Y	Y	Y	✓
Attenuation Storage Tanks	Y				✓
Proprietary treatment systems		Y	Y	Y	✓

12.20 A SuDs treatment train solution will need to be incorporated prior to discharging the surface water run-off from the site to avoid detriment to the water quality of the receiving watercourse and runoff through the site.

12.21 With reference to the SuDS Manual chapter 26 a simple index approach to water quality risk management will be undertaken. This approach would need to be agreed with the SAB.

Standard S4 & S5 – Amenity & Biodiversity

12.22 The aim of the Standard S4 & S5 is to ensure the SuDs scheme makes the best contribution to development design by maximising benefits for amenity and biodiversity as well as water quantity and quality.

12.23 Potential above ground features to satisfy this criteria would be the use of swales, rain gardens, bioretention areas, detention basins and ponds, which can be incorporated within soft landscaping areas of the site, particularly in POS areas.

Standard S6 – Design of Drainage for Construction, Operation & Maintenance

12.24 A SuDS maintenance plan would need to be provided for all SuDS features and submitted as part of the SuDS application to the Sustainable Drainage Approval Body (SAB).

13 WATER DISPLACED BY DEVELOPMENT

13.1 NRW flood data for the 1 in 100year+CC event suggests no flood water volumes would be displaced by the construction of the development.

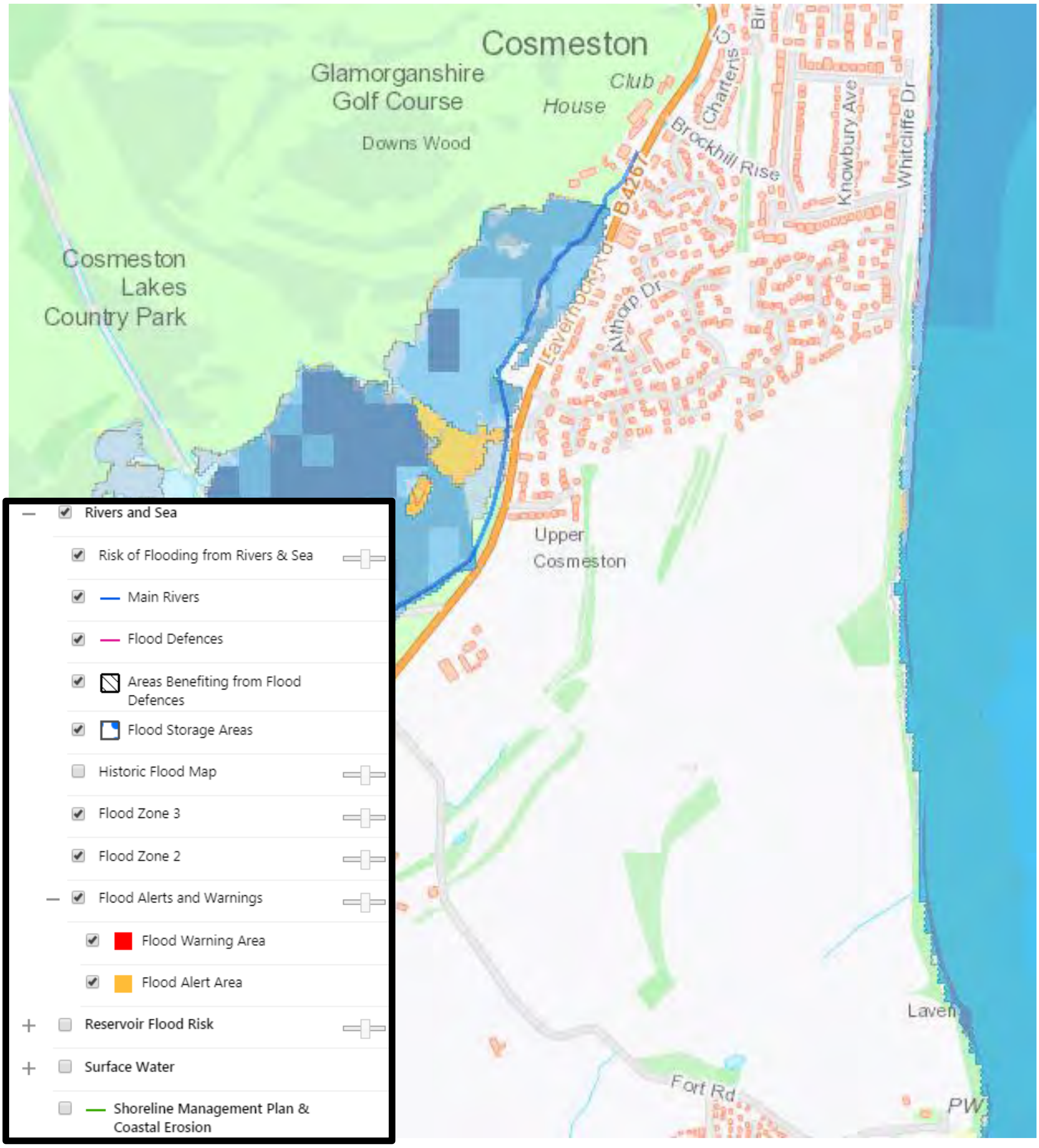


Figure 13.1 – Flood Risk from Rivers and Sea
Source: NRW Long Term Flood Risk Maps

14 IMPACT OF DISPLACED WATER

14.1 The proposed development will incorporate attenuation and SuDS enhancements. The peak flow discharge of the proposed site will be restricted to mimic greenfield run-off rates. These proposals would therefore provide no detriment to downstream properties.

15 LONG-TERM IMPACT OF DEVELOPMENT

15.1 Through the introduction of anticipated attenuation and SuDS enhancements the proposed developed will stand to reduce flood risk to neighbouring / downstream properties. Allowance for climate change will be incorporated into the design to ensure the longevity and robustness of the infrastructure serving the proposed development.

16 ALLOWANCES FOR FUTURE

16.1 There are no future expansion proposals being incorporated into the proposed development at this time.

16.2 In accordance with current best practice, the proposed surface water drainage network will be designed to incorporate a 30% increase in rainfall intensity as a result of anticipated climate change.

17 RESIDUAL RISKS

17.1 The residual risk of flooding originating from outside / within the site which might affect the site include:

- Blockages within the neighbouring watercourse
- Run-off or overflowing drains from extreme rainfall events, from surrounding areas, flowing overland to reach the site.
- Extreme rainfall events causing ponding on the site itself.
- Infrastructure failure / blockage on the site.
- High groundwater levels in excessively wet periods breaking the surface and ponding.

17.2 Contributory factors which may increase the risk or severity of flooding include:

- Failure to maintain surface water infrastructure.

17.3 In addition to the above, this FCA considers potential sources of flooding from the site which might affect surrounding property:

- Run-off from the site exceeding the capacity of the existing or proposed surface water management system and overflowing onto adjacent land;

- Run-off from the site as the result of extreme rainfall contributing to a rise in water level in the surrounding network / rivers downstream and affecting riparian property.

17.4 A significant residual risk lies with lack of maintenance to the network with attenuation structures and outlet flow controls being particularly vulnerable. A regular inspection and maintenance regime should be incorporated to remove build-up of debris and de-silt as required to ensure optimal flow conditions and hydraulic performance of the network.

17.5 The most significant residual risks in relation to the fluvial flood risk to the development and potential adverse effects to 3rd party land.

18 SUMMARY

18.1 The development satisfies TAN 15.

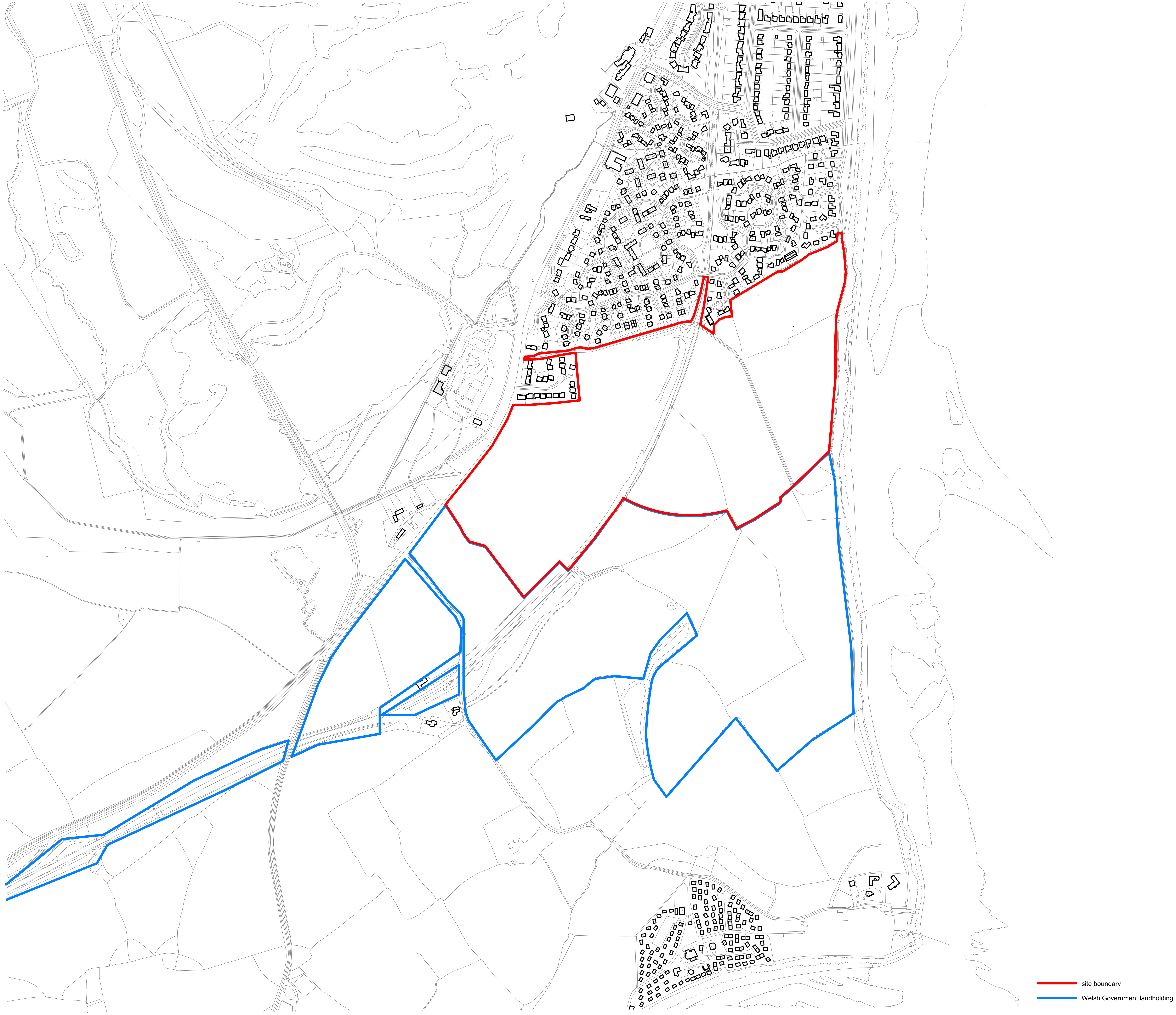
18.2 The surface water drainage strategy proposes a restricted discharge into Sully Brook. Attenuation storage and interception will be provided by a SuDS drainage design which includes, infiltration structures, porous paving systems, bioretention areas, rain gardens, filter drains, detention basins and attenuation ponds.

18.3 The strategy and design of the SuDS system will comply with the Statutory Standards for Sustainable Drainage Systems and be subject to SAB approval and adoption.

19 RECOMMENDATIONS

- The SuDs application should be progressed to coincide with the planning process.
- Further infiltration testing will be required to establish whether infiltration solutions are feasible on the site.
- External level design should achieve falls from building thresholds, direct overland flows to less sensitive / designated overflow areas without compromising routes of access / egress and mitigating risk of harm to persons or property.
- The residual risks should be reviewed as the design development progresses.
- A regular inspection and maintenance regime should be developed to ensure debris build up is removed and de-silting is undertaken as required to maintain continual optimal flow conditions and hydraulic performance.

APPENDIX A – Site location



1 Existing Site Plan

1 : 2500

Rev	Description	Drawn	Checked	Date Issued
P1	Initial Issue	TE	MR	18.01.19
P2	Including WG ownership boundary	TS	TS	15.08.19

Drawn	TE
Date	02.05.19
Scale @ A0	1 : 2500
Status	S0

Austin-Smith:Lord LLP
Architects Designers Planners
Landscape Architects
one Dunleavy Drive
Cardiff
CF11 0SN
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e cardiff@austinsmithlord.com

Drawings and models powered by Austin-Smith:Lord LLP BIM using AutoDesk Revit

N

Metres 20 40 60 80 100

Austin-Smith:Lord

Project Upper Farm Cosmeston

Description Existing Site Plan

Job No.	Drawing No.	Revision
318054	UFC- ASL- 00- 00- DR- A- 0900	

APPENDIX B – Development Proposals

10 20 30 40 50
Metres

KEY

	NEAP	1000 m^2
	LEAP	3x 400 m^2
	LAP	4x 100 m^2
	Retained hedgerow	29 600 m^2
	New hedgerow	10 300 m^2
	Grass/meadow, orchards or allotments	19 600 m^2
	Private gardens soft landscape	25 000 m^2
	SuDS swales and reed beds	24 100 m^2
	Attenuation pond (surface area)	2000 m^2

Rev	Description	Drawn	Checked	Date Issued
P1	Prefered Option Issue	TE	TS	24.06.19
P2	Workshop 28.06.19 Revisions	TE	TS	03.07.19
P3	Revised boundary line	TS	TS	28.08.19
P4	Community Football Pitch added	TS	TS	5.12.19
P5	Revised Layout Option 6	TS	TS	5.08.20

2 Proposed Masterplan

1 : 1000

Drawn: Author
Date: 02.05.19
Scale @ A0: 1 : 1000
Status

Austin-Smith:Lord LLP
Architects Designers Planners
Landscape Architects
one Dunleavy Drive
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Drawings and models powered by Austin-Smith:Lord LLP BIM using AutoDesk Revit

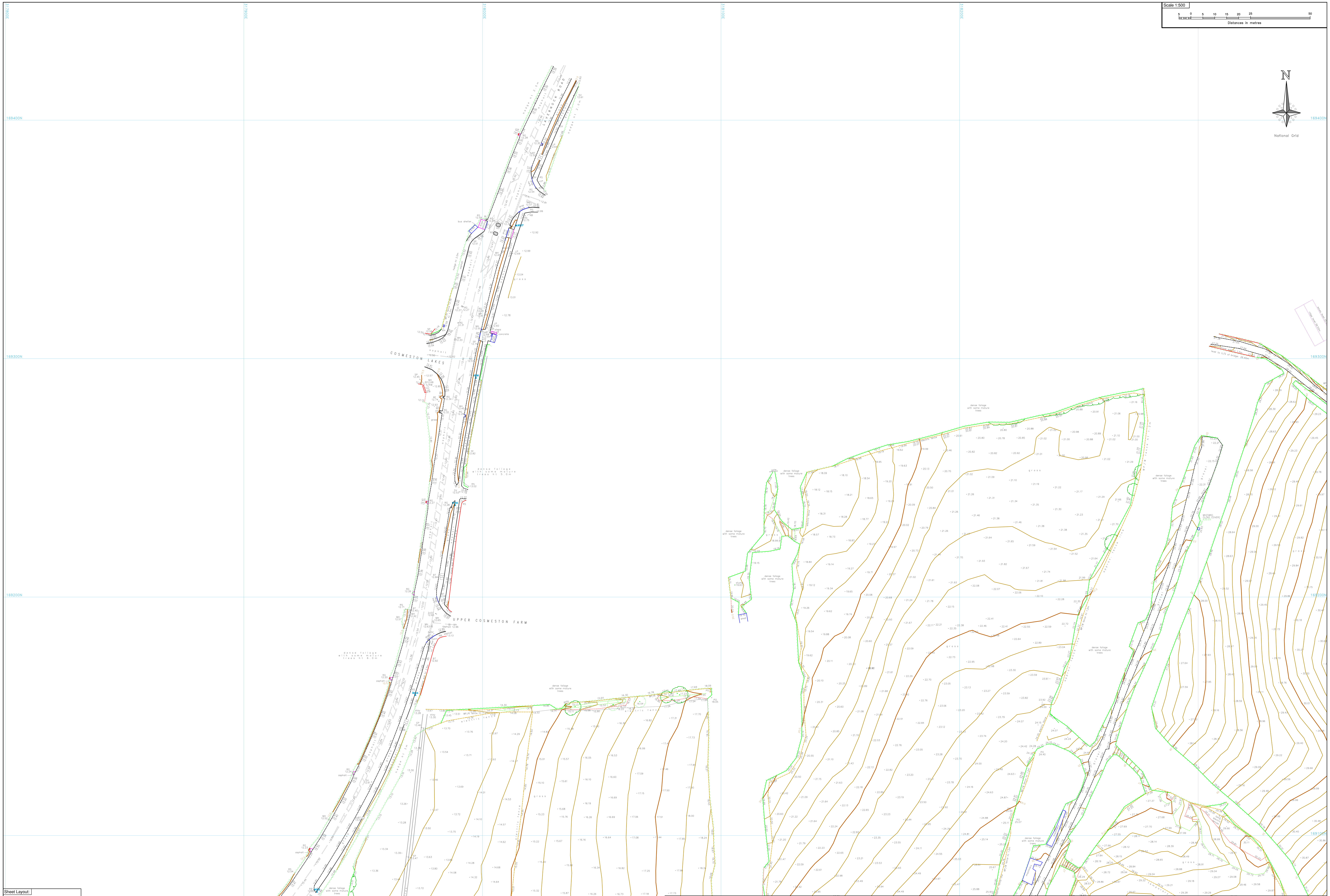
Austin-Smith:Lord

Project Upper Farm Cosmeston

Description Proposed Masterplan

Job No.	Drawing No.	Revision
318054	UFC- ASL- 00- 00- DR- A- 0930	

APPENDIX C – Topographical Survey



Sheet Layout:

Dwg No. Sheet 1

Dwg No. Sheet 2

Dwg No. Sheet 3

THE SURVEY ASSOCIATION

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Environmental Data - Land Registry Title Plans

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Abbreviations:

B/RW	brick retaining wall
BB	Belisha beacon
BI	bollard (illuminated)
BL	bollard
BT	telecom inspection cover
BW	brick wall
C/RW	concrete retaining wall
CATV	cable television cover
CB	close boarded
CM	corrugated metal
conc.	concrete
CP/BW	concrete post & barbed wire
CP/CL	concrete post & chain link
CP/CP	concrete post & panel
CP/W	concrete post & wire mesh
CPS	concrete paving slabs
DC	drainage channel
DK	drop kerb
DR	drain
EP	electricity pole
ER	earthing rod
FB	flower bed
FFL	finished floor level
FS	flagstaff
G/W	gabion wall
GP	gate post
GV	gas valve
HR	handrail
HY	fire hydrant
IC	inspection cover (general)
IR	metal railings
Iwn	interwoven wood slat
JB	junction box
KO	kerb outlet
LP	lamp post
MH	manhole
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MM	metal mesh
MP	mile post
NB	name board
O/H	overhead
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OHC	overhead cable/wire
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PO	post
RE	rodding eye
RG	road gully
RP	reflector post
RS	road sign
RSJ	rolled steel joist
RWP	rain water pipe
S/RW	stone retaining wall
Sap.	sapling
SP	sign post
SPS	stone paving slabs
stay	stay wire
STN	survey control station
SV	water stop valve
SVP	soil vent pipe
tact.	tactile paving
THL	threshold level
TL	traffic light
TP	telephone pole
VP	vent pipe
Wlap	wood lap
WM	water meter
WP/BW	wood post & barbed wire
WP/R	wood post & rail
WP/W	wood post & wire
ht	height (of feature)
↑	arrow indicates up (unless otherwise stated)
△9002	survey control point

Drainage features:

CL	cover level
ID	invert depth
IL	invert level
FWS	foul water sewer
SWS	storm water sewer
CWS	combined water sewer
UTD	unable to determine
UTL	unable to lift
ø	pipe diameter (mm)
SL	soffit level
←	arrow indicates direction of flow

Notes:

Survey Extension of PB2981-01 (dated November 2016).

Revisions:

ALS

- Topographical Surveys
- Engineering Surveys
- Measured Building Surveys
- Boundary Surveys
- OS Mapping and Data Centre
- Underground Utility Surveys

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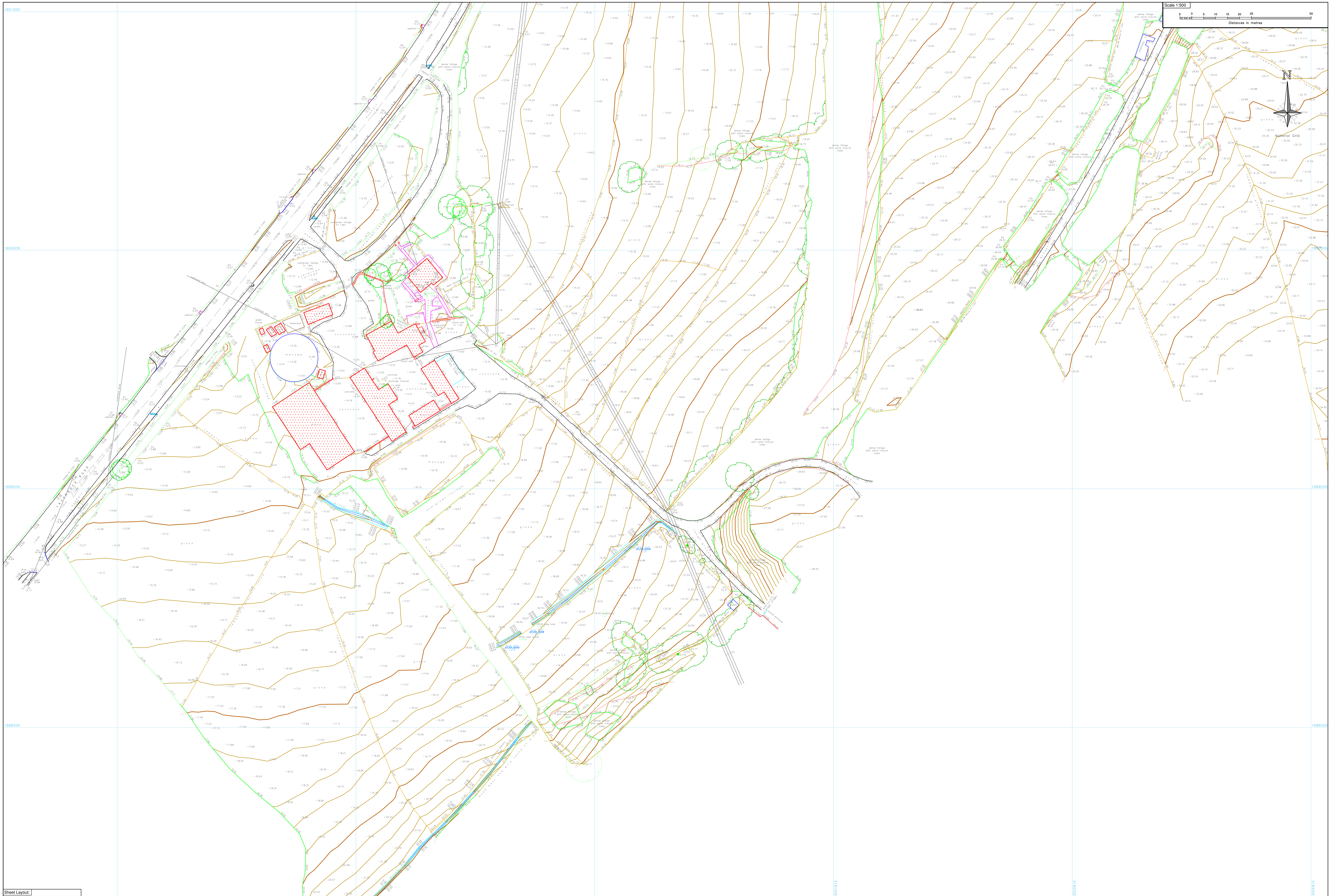
Tel: 01633 263575 Fax: 01633 213767

Cosmeston Farm
Penarth

Topographical Survey

Client	WSP						
Coord Grid	Plane Grid based on National Grid			Level Datum	Level Datum via Active GPS Network		
Scale	1:500@A0	Date	Oct 2017	Status	Final	Job No.	WP3329
Surveyed	A. Jollffe	Drawn	C. J. Sullivan	Checked	R. Williams	Dwg. No.	WP3329-01



Sheet Layout:
Dwg No. Sheet 1
Dwg No. Sheet 3
Dwg No. Sheet 2

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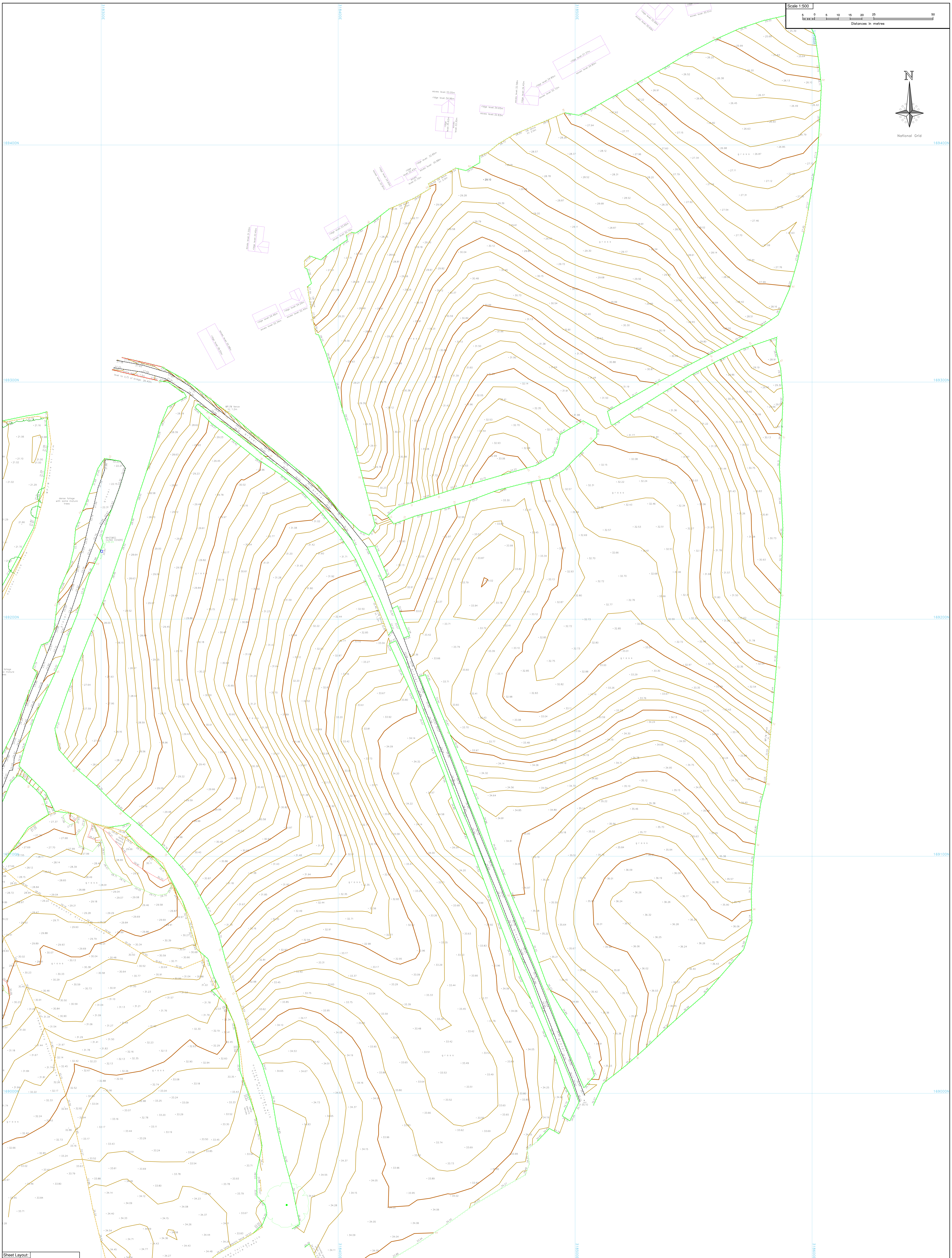

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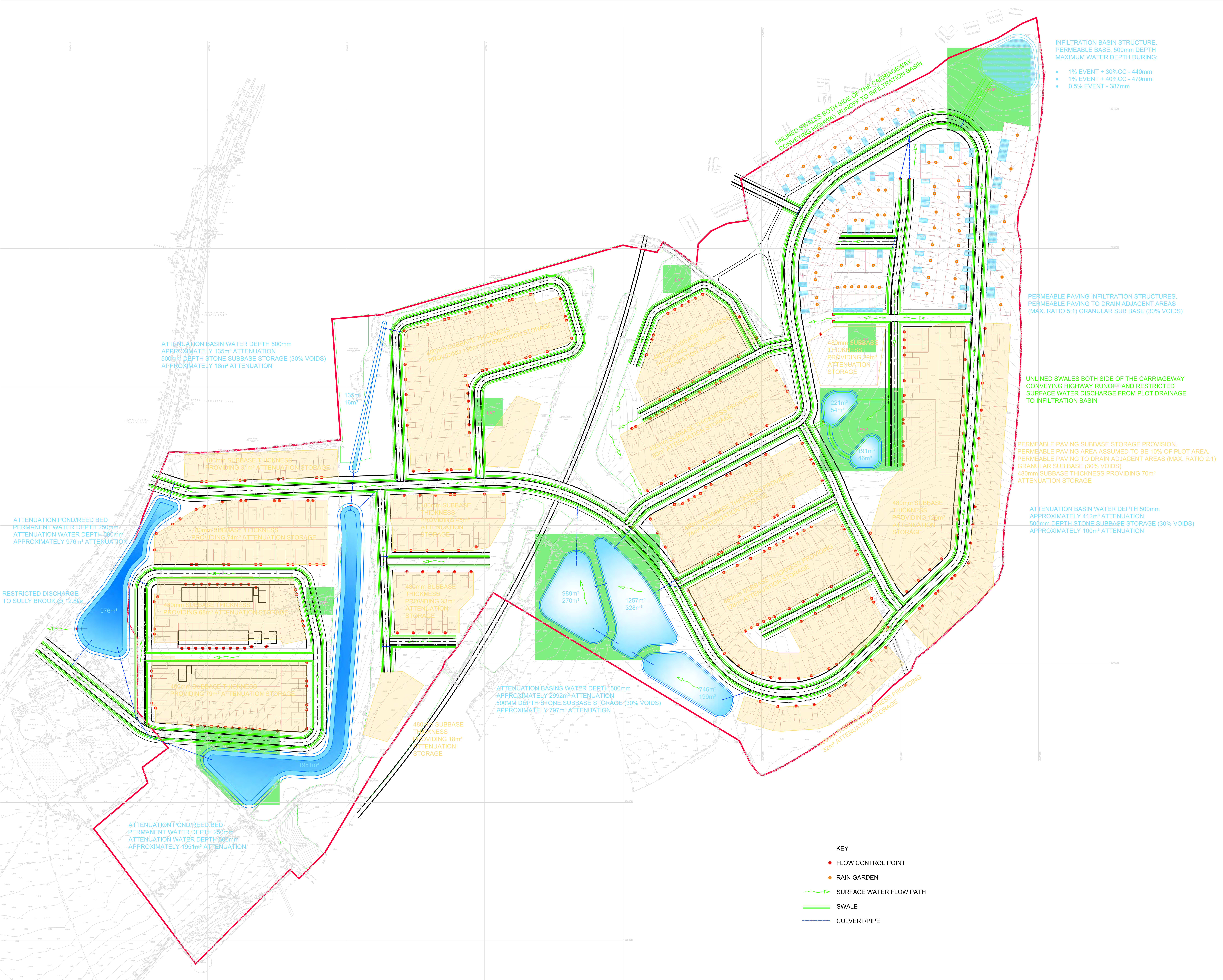
Dwg. No.	WP3329-01				

APPENDIX D – Proposed SuDS Strategy and SAB Response



DO NOT SCALE FROM THIS DRAWING.

CONTRACTORS MUST CHECK ALL DIMENSIONS ON SITE. ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. DISCREPANCIES MUST BE REPORTED IMMEDIATELY TO CAMBRIA CONSULTING LIMITED BEFORE PROCEEDING.

THE CONTRACTOR IS TO REFER TO THE SPECIFICATION, FULL SCHEDULE OF RESIDUAL RISKS IN THE CONTRACT DOCUMENTATION AND ALSO TO INFORMATION FROM OTHER DESIGNERS, IN PARTICULAR THE M&E CONSULTANT REGARDING EXISTING LIVE SERVICES.

THIS SYMBOL IS USED TO HIGHLIGHT INSTANCES OF RISK WITHIN THE CONSTRUCTION PROCESS.

ALWAYS CHECK FOR LATER REVISIONS OF THIS DRAWING.

Rev.	Description	By	Chk	App
P01	FIRST ISSUE FOR COMMENT 15/03/19	CP	BW	WJ

Client:

Austin-Smith:Lord

Project:

UPPER COSMESTON FARM

Drawing Title:

SUSTAINABLE DRAINAGE STRATEGY CONCEPT

Drawing No.

Project No.	Org.	Vol.	Level	Type	Dis.	Class	No.
CC1857	CAM	ZZ	XX	SK	C	52	0125

Suitability Status:	Scale @A1:	Rev:
PRELIMINARY	1:1250	P01

CAMBRIA
Constructive Thinking
Civil & Structural Engineers
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16 Plas St. Pol de Leon
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Cardiff, CF64 1TR
T 029 2009 3333
E admin@cambria.co.uk
W www.cambria.co.uk
@cambriauk
uk.linkedin.com/in/cambriauk

MEMORANDUM / COFNOD

The Vale of Glamorgan Council
The Alps, Wenvoe, CF5 6AA

VALE of GLAMORGAN
BRO MORGANNWG

To / I:	Callum Parker
Dept / Adran:	
Date / Dyddiad:	02/05/2019
Your Ref / Eich Cyf:	

From / Oddi Wrth:	Vale of Glamorgan County Council SuDS Approval Body
My Ref / Cyf:	SAB/PRE/2019/006
Tel / Ffôn:	02920 673 235
Fax / Ffacs:	02920 673 114

Subject / Testyn: **Pre-Application No. SAB/PRE/2019/006 Upper Cosmeston Farm, Penarth**
Proposal: **Construction of new residential development and school.**

The Flood and Water Management Act 2010 (Schedule 3), implemented in Wales on January 7th 2019 requires all new developments to include Sustainable Drainage System features that are compliant with national standards.

Overview:
Information submitted to support this pre-application suggests that surface waters generated by the development will be disposed of via a combination of rainwater harvesting, infiltration together with a discharge to a surface watercourse (Sully Brook).

Standard S1 – Surface Water Runoff Destination

Priority Level 1: Collection for Use:
The submitted pre-application form indicates that rainwater harvesting will be utilised where possible by the inclusion of rainwater butts at individual property level. It is recognised that water is a valuable resource and we would be in favour of the collection of rainwater for non-portable use where practicable.

Priority Level 2: Discharge of surface water into ground:
The submitted pre-application form also indicates that surface water will be disposed of through the use of infiltration techniques. Infiltration test results submitted in support of this application indicate that infiltration at shallow depths to be generally poor. Falling head permeability test results have also been provided to demonstrate the sites permeability at greater depth. In line with the Environment Agency's Approach to Groundwater Protection (February 2018) adopted by NRW we would discourage the use of any infiltration system that bypasses the soil layer, limiting the ability of the ground to attenuate pollutants.

Where the use of shallow infiltration features are to be used all testing should be undertaken at the proposed site of infiltration inclusive of permeable surfaces. Where larger infiltration systems are to be used we would require additional testing to be undertaken on a 25m grid basis. Infiltration testing should be completed at an appropriate depth to that of the proposed design.

Priority Level 3: Discharge to a Surface Water Body:
It has also been suggested within the pre-application form that surface waters not collected or discharged to ground under priority levels 1 and 2 will be discharged to Sully Brook adjacent to Lavernock Road. Although we have no objection to this method of disposal in principle, on full application further information will be required with regard to the location of proposed discharge point.

The design of any off-site drainage system should demonstrate that the scheme does not adversely affect off-site flood risk elsewhere. Documented evidence of a right to discharge will also be required with the riparian owner at the proposed point of discharge.

Priority Level 4: Discharge to surface water sewer or highway:

It has been acknowledged that the submitted pre-application does not propose to discharge surface water directly into surface water sewer, highway drain or any other drainage system.

Priority Level 5: Discharge to combined sewer:

It has been acknowledged that the submitted pre-application does not propose to discharge surface waters directly to combined sewer.

Standard S2 – Surface Water Runoff Hydraulic Control

It has been indicated that the drainage scheme will provide hydraulic control up to a 1 in 100 year return period + 30% allowance for climate change. No hydraulic calculations have been provided at this stage and will be required to be submitted on full application. The surface water drainage scheme should be designed so that flooding does not occur on any part of the site for a 1 in 30 year return period plus climate change (30%) and not in any part of any building for a 1 in 100 year return period plus climate change with consideration made to any receiving flows from outside of the catchment. The submitted calculations should also include the volume of storage utilised within the drainage system.

It is accepted that the proposed drainage system would manage flows for the majority of rainfall events of less than 5mm through infiltration and interception.

The submitted drainage concept drawing identifies the location of an infiltration basin on the northern boundary of the site. NRW flood mapping has indicated that Whitcliffe Drive directly north of the proposed basin is situated in an area of high flood risk. This is also supported by our historical records which documents a known flood incident at Whitcliffe Drive during March 2013. Due to the proximity of the basin to a known flood risk area together with unsuccessful infiltration testing at the location (E-TP25) we hold concerns regarding the positioning of the infiltration basin in relation to the properties at Whitcliffe Drive. On full application we would require the potential impact on flood risk offsite towards Whitcliffe Drive to have been fully considered. This could potentially require a change in the form or location of drainage features serving this area of the development.

It is also noted within the concept drawing that the northern swales adjacent to the central attenuation basins drain to an overland flow path. Further detail is required with regard to this overland feature and it will be the intention of the Vale of Glamorgan Council to explore the potential designation of this feature in order to protect the area from any future alterations.

It is stated within the pre-application form that surface waters not collected or discharged to ground under priority levels 1 and 2 will be discharged at a restricted rate of 12.8l/s to Sully Brook. We find this discharge rate acceptable in principle and would request further hydraulic calculations demonstrating the proposed discharge to Sully Brook on full application.

Standard S3 – Water Quality

The proposed drainage scheme has the potential to allow the effective management of sediment and other pollutants, ensuring discharges from the system are of an acceptable quality and will not cause a pollution risk. Given the use of features allowing interception throughout the system together with the inclusion of shallower infiltration features we are in general agreement that the drainage scheme proposed will adequately manage water quality. The various stages in the SuDS also increase the potential for managing pollution incidents close to source before they discharge offsite. No hydraulic calculations have been provided at this stage and will be required to be submitted on full application, demonstrating adequate residency times for flows to allow appropriate treatment within the system.

However to reiterate our previous statement above, we would discourage the use of any deeper Infiltration system that would inhibit the ability of the soil layer to attenuate pollutants and protect the receiving groundwaters.

Standard S4 – Amenity

We acknowledge that the proposed drainage scheme maximises amenity benefits through the promotion of green space whilst also providing enhanced visual character. It would be requested on full application that an appropriate risk assessment is submitted that considers the proximity of LAP / LEAP to any proposed pond / basin and that any such risk is adequately managed. We offer no objection to the amenity benefits the scheme will bring.

Standard S5 – Biodiversity

We acknowledge that the proposed drainage scheme will provide a self – sustaining ecosystem and will contribute to the delivery of local biodiversity objectives. Therefore we offer no objection to the biodiversity benefits the scheme will bring. It should be noted that the creation of permanent water bodies could provide habitats for protected species such as Great Crested Newts. As such appropriate consideration should be given to reduce or mitigate the potential risk of fatalities in features such as highway gully pots.

Standard S6 – Design

At this pre-application stage limited information has been provided with regard to the construction, operation and maintenance of the drainage system. All elements of the surface water drainage system should be designed to ensure maintenance and operation can be undertaken by the responsible body easily, safely, cost effectively and in a timely manner.

The Typical SuDS Construction Detail plan submitted with this application proposes the use of a stone / crushed rock layer at the bottom of the basins. In order to maximise amenity benefits for future residents we would request that the stone layer is removed from the basin and that the any basins takes on a more natural look where possible.

Conclusion

An appraisal of this application has been made by the SuDS Approval Body in line with Welsh Governments Statutory Standards for Sustainable Drainage Systems. From the details provided as part of this pre-application we offer no objection in principle to the proposed drainage scheme.

Gareth Thelwell-Davies
Engineer – Environment

for Operational Manager Environment and Engineering
ar gyfer Rheolwr Gweithredol Amgylchedd a Pheirianneg

APPENDIX E – FEH Greenfield Runoff Rate

FEH Mean Annual Flood

Input

Site Location	GB 317700 168950 ST 17700 68950
Area (ha)	246.500
SAAR (mm)	931
URBEXT (USER)	0.0000
SPRHOST	49.160
BFIHOST	0.274
FARL	1.000

Results

QMED Rural (l/s) 1430.2 QMED Urban (l/s) 1430.2

APPENDIX F – Attenuation Storage Volumes

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	12.944	0.444	35.6	1216.8	O K
30 min Summer	13.026	0.526	35.6	1453.3	O K
60 min Summer	13.117	0.617	35.6	1722.7	O K
120 min Summer	13.215	0.715	35.6	2014.7	Flood Risk
180 min Summer	13.272	0.772	35.6	2187.1	Flood Risk
240 min Summer	13.309	0.809	35.6	2300.4	Flood Risk
360 min Summer	13.351	0.851	35.6	2430.3	Flood Risk
480 min Summer	13.370	0.870	35.6	2489.4	Flood Risk
600 min Summer	13.377	0.877	35.6	2511.1	Flood Risk
720 min Summer	13.380	0.880	35.6	2522.9	Flood Risk
960 min Summer	13.367	0.867	35.6	2481.1	Flood Risk
1440 min Summer	13.332	0.832	35.6	2372.8	Flood Risk
2160 min Summer	13.268	0.768	35.6	2175.2	Flood Risk
2880 min Summer	13.194	0.694	35.6	1952.1	O K
4320 min Summer	13.054	0.554	35.6	1536.4	O K
5760 min Summer	12.942	0.442	35.6	1211.6	O K
7200 min Summer	12.858	0.358	35.5	974.2	O K
8640 min Summer	12.799	0.299	35.0	808.0	O K
10080 min Summer	12.760	0.260	34.4	699.2	O K
15 min Winter	12.996	0.496	35.6	1366.0	O K
30 min Winter	13.087	0.587	35.6	1633.5	O K
60 min Winter	13.190	0.690	35.6	1939.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	162.544	0.0	1146.6	26
30 min Summer	97.903	0.0	1390.6	40
60 min Summer	58.969	0.0	1760.5	70
120 min Summer	35.518	0.0	2126.5	128
180 min Summer	26.403	0.0	2373.5	186
240 min Summer	21.393	0.0	2565.2	246
360 min Summer	15.903	0.0	2860.8	364
480 min Summer	12.885	0.0	3089.6	480
600 min Summer	10.945	0.0	3278.2	562
720 min Summer	9.579	0.0	3439.6	614
960 min Summer	7.646	0.0	3652.0	740
1440 min Summer	5.565	0.0	3956.5	1004
2160 min Summer	4.051	0.0	4446.3	1424
2880 min Summer	3.233	0.0	4730.0	1816
4320 min Summer	2.335	0.0	5103.9	2556
5760 min Summer	1.854	0.0	5453.3	3280
7200 min Summer	1.550	0.0	5694.5	3960
8640 min Summer	1.339	0.0	5894.4	4592
10080 min Summer	1.183	0.0	6055.2	5248
15 min Winter	162.544	0.0	1290.4	26
30 min Winter	97.903	0.0	1561.8	40
60 min Winter	58.969	0.0	1975.6	68

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	13.300	0.800	35.6	2275.3	Flood Risk
180 min Winter	13.364	0.864	35.6	2470.9	Flood Risk
240 min Winter	13.405	0.905	35.6	2600.9	Flood Risk
360 min Winter	13.455	0.955	35.6	2757.7	Flood Risk
480 min Winter	13.480	0.980	35.6	2837.5	Flood Risk
600 min Winter	13.492	0.992	35.6	2873.6	Flood Risk
720 min Winter	13.494	0.994	35.6	2882.1	Flood Risk
960 min Winter	13.473	0.973	35.6	2813.5	Flood Risk
1440 min Winter	13.425	0.925	35.6	2664.1	Flood Risk
2160 min Winter	13.335	0.835	35.6	2381.3	Flood Risk
2880 min Winter	13.227	0.727	35.6	2050.3	Flood Risk
4320 min Winter	13.011	0.511	35.6	1409.8	O K
5760 min Winter	12.856	0.356	35.5	967.7	O K
7200 min Winter	12.764	0.264	34.5	711.9	O K
8640 min Winter	12.731	0.231	31.2	619.1	O K
10080 min Winter	12.710	0.210	27.9	562.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	35.518	0.0	2384.7	126
180 min Winter	26.403	0.0	2661.0	184
240 min Winter	21.393	0.0	2875.4	240
360 min Winter	15.903	0.0	3205.6	356
480 min Winter	12.885	0.0	3460.8	468
600 min Winter	10.945	0.0	3670.9	576
720 min Winter	9.579	0.0	3850.2	680
960 min Winter	7.646	0.0	4084.7	774
1440 min Winter	5.565	0.0	4412.7	1082
2160 min Winter	4.051	0.0	4982.0	1540
2880 min Winter	3.233	0.0	5300.0	1968
4320 min Winter	2.335	0.0	5724.8	2720
5760 min Winter	1.854	0.0	6110.2	3352
7200 min Winter	1.550	0.0	6381.2	3904
8640 min Winter	1.339	0.0	6606.9	4576
10080 min Winter	1.183	0.0	6791.7	5248

Model Details

Storage is Online Cover Level (m) 13.500

Tank or Pond Structure

Invert Level (m) 12.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2619.0	0.700	3013.8	1.400	0.0	2.100	0.0
0.100	2673.7	0.800	3072.5	1.500	0.0	2.200	0.0
0.200	2729.0	0.900	3131.7	1.600	0.0	2.300	0.0
0.300	2784.8	1.000	3191.5	1.700	0.0	2.400	0.0
0.400	2841.2	1.100	0.0	1.800	0.0	2.500	0.0
0.500	2898.2	1.200	0.0	1.900	0.0		
0.600	2955.7	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0255-3560-1000-3560
Design Head (m)	1.000
Design Flow (l/s)	35.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	255
Invert Level (m)	12.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	35.6
Flush-Flo™	0.400	35.6
Kick-Flo®	0.759	31.2
Mean Flow over Head Range	-	29.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.2	1.200	38.8	3.000	60.4	7.000	91.3
0.200	26.1	1.400	41.8	3.500	65.1	7.500	94.4
0.300	35.0	1.600	44.6	4.000	69.5	8.000	97.4
0.400	35.6	1.800	47.2	4.500	73.6	8.500	100.3
0.500	35.3	2.000	49.7	5.000	77.5	9.000	103.2
0.600	34.4	2.200	52.0	5.500	81.1	9.500	105.9
0.800	32.0	2.400	54.3	6.000	84.7		
1.000	35.6	2.600	56.4	6.500	88.0		

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	17.935	0.435	28.6	981.9	O K
30 min Summer	18.015	0.515	28.6	1172.9	O K
60 min Summer	18.104	0.604	28.6	1390.1	O K
120 min Summer	18.198	0.698	28.6	1625.1	O K
180 min Summer	18.253	0.753	28.6	1763.6	Flood Risk
240 min Summer	18.289	0.789	28.6	1855.0	Flood Risk
360 min Summer	18.330	0.830	28.6	1959.6	Flood Risk
480 min Summer	18.348	0.848	28.6	2006.9	Flood Risk
600 min Summer	18.355	0.855	28.6	2023.4	Flood Risk
720 min Summer	18.358	0.858	28.6	2031.4	Flood Risk
960 min Summer	18.344	0.844	28.6	1995.1	Flood Risk
1440 min Summer	18.308	0.808	28.6	1903.7	Flood Risk
2160 min Summer	18.243	0.743	28.6	1738.1	Flood Risk
2880 min Summer	18.171	0.671	28.6	1556.3	O K
4320 min Summer	18.034	0.534	28.6	1220.5	O K
5760 min Summer	17.924	0.424	28.6	956.6	O K
7200 min Summer	17.841	0.341	28.6	763.1	O K
8640 min Summer	17.783	0.283	28.2	627.5	O K
10080 min Summer	17.744	0.244	27.7	538.4	O K
15 min Winter	17.985	0.485	28.6	1102.4	O K
30 min Winter	18.075	0.575	28.6	1318.4	O K
60 min Winter	18.174	0.674	28.6	1564.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	162.544	0.0	934.3	26
30 min Summer	97.903	0.0	1132.0	40
60 min Summer	58.969	0.0	1426.1	70
120 min Summer	35.518	0.0	1722.0	128
180 min Summer	26.403	0.0	1921.8	186
240 min Summer	21.393	0.0	2076.9	246
360 min Summer	15.903	0.0	2316.0	364
480 min Summer	12.885	0.0	2501.2	482
600 min Summer	10.945	0.0	2654.0	568
720 min Summer	9.579	0.0	2784.8	620
960 min Summer	7.646	0.0	2957.2	744
1440 min Summer	5.565	0.0	3205.4	1010
2160 min Summer	4.051	0.0	3593.2	1428
2880 min Summer	3.233	0.0	3822.7	1816
4320 min Summer	2.335	0.0	4126.6	2560
5760 min Summer	1.854	0.0	4404.5	3288
7200 min Summer	1.550	0.0	4599.7	3960
8640 min Summer	1.339	0.0	4761.9	4592
10080 min Summer	1.183	0.0	4893.4	5248
15 min Winter	162.544	0.0	1050.7	26
30 min Winter	97.903	0.0	1270.7	40
60 min Winter	58.969	0.0	1600.0	68

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	18.282	0.782	28.6	1835.9	Flood Risk
180 min Winter	18.343	0.843	28.6	1993.6	Flood Risk
240 min Winter	18.383	0.883	28.6	2098.4	Flood Risk
360 min Winter	18.432	0.932	28.6	2224.7	Flood Risk
480 min Winter	18.456	0.956	28.6	2289.0	Flood Risk
600 min Winter	18.467	0.967	28.6	2317.9	Flood Risk
720 min Winter	18.469	0.969	28.6	2324.6	Flood Risk
960 min Winter	18.447	0.947	28.6	2266.0	Flood Risk
1440 min Winter	18.400	0.900	28.6	2142.4	Flood Risk
2160 min Winter	18.311	0.811	28.6	1910.0	Flood Risk
2880 min Winter	18.203	0.703	28.6	1635.7	Flood Risk
4320 min Winter	17.992	0.492	28.6	1118.5	O K
5760 min Winter	17.839	0.339	28.6	757.9	O K
7200 min Winter	17.748	0.248	27.8	548.4	O K
8640 min Winter	17.714	0.214	25.2	472.1	O K
10080 min Winter	17.695	0.195	22.6	428.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	35.518	0.0	1930.8	126
180 min Winter	26.403	0.0	2154.2	184
240 min Winter	21.393	0.0	2327.6	242
360 min Winter	15.903	0.0	2594.8	356
480 min Winter	12.885	0.0	2801.4	468
600 min Winter	10.945	0.0	2971.5	578
720 min Winter	9.579	0.0	3116.8	682
960 min Winter	7.646	0.0	3307.2	778
1440 min Winter	5.565	0.0	3574.4	1084
2160 min Winter	4.051	0.0	4025.8	1544
2880 min Winter	3.233	0.0	4283.1	1968
4320 min Winter	2.335	0.0	4627.9	2724
5760 min Winter	1.854	0.0	4934.8	3352
7200 min Winter	1.550	0.0	5154.0	3904
8640 min Winter	1.339	0.0	5337.0	4576
10080 min Winter	1.183	0.0	5487.8	5248

Model Details

Storage is Online Cover Level (m) 18.500

Tank or Pond Structure

Invert Level (m) 17.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2150.0	0.700	2509.0	1.400	0.0	2.100	0.0
0.100	2199.6	0.800	2562.6	1.500	0.0	2.200	0.0
0.200	2249.8	0.900	2616.7	1.600	0.0	2.300	0.0
0.300	2300.5	1.000	2671.4	1.700	0.0	2.400	0.0
0.400	2351.8	1.100	0.0	1.800	0.0	2.500	0.0
0.500	2403.6	1.200	0.0	1.900	0.0		
0.600	2456.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0232-2870-1000-2870
Design Head (m)	1.000
Design Flow (l/s)	28.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	232
Invert Level (m)	17.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	28.7
Flush-Flo™	0.376	28.6
Kick-Flo®	0.745	24.9
Mean Flow over Head Range	-	23.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.7	1.200	31.3	3.000	48.6	7.000	73.3
0.200	23.3	1.400	33.7	3.500	52.4	7.500	75.9
0.300	28.4	1.600	35.9	4.000	55.9	8.000	78.3
0.400	28.6	1.800	38.0	4.500	59.2	8.500	80.6
0.500	28.2	2.000	40.0	5.000	62.3	9.000	82.9
0.600	27.5	2.200	41.9	5.500	65.2	9.500	85.1
0.800	25.8	2.400	43.7	6.000	68.0		
1.000	28.7	2.600	45.4	6.500	70.8		

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	28.702	0.202	28.0	1300.4	Flood Risk
30 min Summer	28.741	0.241	35.1	1551.0	Flood Risk
60 min Summer	28.784	0.284	37.0	1838.0	Flood Risk
120 min Summer	28.832	0.332	37.5	2154.0	Flood Risk
180 min Summer	28.860	0.360	37.5	2342.0	Flood Risk
240 min Summer	28.880	0.380	37.5	2470.1	Flood Risk
360 min Summer	28.904	0.404	37.5	2631.0	Flood Risk
480 min Summer	28.917	0.417	37.5	2719.2	Flood Risk
600 min Summer	28.925	0.425	37.5	2772.4	Flood Risk
720 min Summer	28.931	0.431	37.5	2814.4	Flood Risk
960 min Summer	28.932	0.432	37.5	2818.6	Flood Risk
1440 min Summer	28.926	0.426	37.5	2782.7	Flood Risk
2160 min Summer	28.908	0.408	37.5	2663.6	Flood Risk
2880 min Summer	28.886	0.386	37.5	2513.7	Flood Risk
4320 min Summer	28.837	0.337	37.5	2185.6	Flood Risk
5760 min Summer	28.795	0.295	37.2	1910.1	Flood Risk
7200 min Summer	28.763	0.263	36.7	1700.2	Flood Risk
8640 min Summer	28.742	0.242	35.3	1559.4	Flood Risk
10080 min Summer	28.727	0.227	32.7	1460.3	Flood Risk
15 min Winter	28.726	0.226	32.5	1455.7	Flood Risk
30 min Winter	28.769	0.269	36.8	1738.6	Flood Risk
60 min Winter	28.819	0.319	37.4	2065.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	162.544	0.0	920.3	26
30 min Summer	97.903	0.0	1156.6	41
60 min Summer	58.969	0.0	1667.7	70
120 min Summer	35.518	0.0	2041.5	128
180 min Summer	26.403	0.0	2292.4	186
240 min Summer	21.393	0.0	2486.0	244
360 min Summer	15.903	0.0	2781.7	362
480 min Summer	12.885	0.0	3007.5	480
600 min Summer	10.945	0.0	3191.1	540
720 min Summer	9.579	0.0	3345.8	602
960 min Summer	7.646	0.0	3541.8	724
1440 min Summer	5.565	0.0	3803.5	988
2160 min Summer	4.051	0.0	4542.6	1392
2880 min Summer	3.233	0.0	4821.7	1792
4320 min Summer	2.335	0.0	5148.2	2556
5760 min Summer	1.854	0.0	5676.3	3288
7200 min Summer	1.550	0.0	5913.8	3968
8640 min Summer	1.339	0.0	6097.9	4672
10080 min Summer	1.183	0.0	6221.8	5352
15 min Winter	162.544	0.0	1059.7	26
30 min Winter	97.903	0.0	1325.1	40
60 min Winter	58.969	0.0	1888.7	68

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
120 min Winter	28.873	0.373	37.5	2427.6	Flood Risk
180 min Winter	28.906	0.406	37.5	2646.0	Flood Risk
240 min Winter	28.928	0.428	37.5	2797.6	Flood Risk
360 min Winter	28.958	0.458	37.5	2994.5	Flood Risk
480 min Winter	28.975	0.475	37.5	3110.1	Flood Risk
600 min Winter	28.985	0.485	37.5	3175.3	Flood Risk
720 min Winter	28.990	0.490	37.5	3209.0	Flood Risk
960 min Winter	28.985	0.485	37.5	3180.1	Flood Risk
1440 min Winter	28.973	0.473	37.5	3098.0	Flood Risk
2160 min Winter	28.941	0.441	37.5	2879.1	Flood Risk
2880 min Winter	28.903	0.403	37.5	2623.7	Flood Risk
4320 min Winter	28.827	0.327	37.5	2117.8	Flood Risk
5760 min Winter	28.769	0.269	36.8	1740.3	Flood Risk
7200 min Winter	28.737	0.237	34.5	1526.4	Flood Risk
8640 min Winter	28.717	0.217	30.9	1394.8	Flood Risk
10080 min Winter	28.701	0.201	27.8	1295.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	35.518	0.0	2306.3	126
180 min Winter	26.403	0.0	2586.1	184
240 min Winter	21.393	0.0	2801.8	240
360 min Winter	15.903	0.0	3130.3	356
480 min Winter	12.885	0.0	3380.6	468
600 min Winter	10.945	0.0	3583.7	578
720 min Winter	9.579	0.0	3754.4	680
960 min Winter	7.646	0.0	3968.3	774
1440 min Winter	5.565	0.0	4243.4	1078
2160 min Winter	4.051	0.0	5100.9	1520
2880 min Winter	3.233	0.0	5416.0	1936
4320 min Winter	2.335	0.0	5794.9	2692
5760 min Winter	1.854	0.0	6369.3	3400
7200 min Winter	1.550	0.0	6638.1	4040
8640 min Winter	1.339	0.0	6848.9	4760
10080 min Winter	1.183	0.0	6997.1	5456

Model Details

Storage is Online Cover Level (m) 29.000

Tank or Pond Structure

Invert Level (m) 28.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	6346.0	0.700	0.0	1.400	0.0	2.100	0.0
0.100	6431.0	0.800	0.0	1.500	0.0	2.200	0.0
0.200	6516.6	0.900	0.0	1.600	0.0	2.300	0.0
0.300	6602.7	1.000	0.0	1.700	0.0	2.400	0.0
0.400	6689.4	1.100	0.0	1.800	0.0	2.500	0.0
0.500	6776.7	1.200	0.0	1.900	0.0		
0.600	0.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0268-3760-0500-3760
Design Head (m)	0.500
Design Flow (l/s)	37.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	268
Invert Level (m)	28.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	37.6
Flush-Flo™	0.350	37.5
Kick-Flo®	0.463	36.2
Mean Flow over Head Range	-	25.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.5	1.200	57.3	3.000	89.4	7.000	134.5
0.200	27.6	1.400	61.8	3.500	96.4	7.500	139.3
0.300	37.3	1.600	65.9	4.000	102.9	8.000	144.0
0.400	37.3	1.800	69.8	4.500	109.0	8.500	148.5
0.500	37.6	2.000	73.4	5.000	114.7	9.000	152.8
0.600	41.0	2.200	76.9	5.500	118.9	9.500	157.1
0.800	47.1	2.400	80.2	6.000	124.3		
1.000	52.5	2.600	83.4	6.500	129.5		

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 211 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	25.774	0.274	59.5	851.4	Flood Risk
30 min Summer	25.821	0.321	60.5	1000.9	Flood Risk
60 min Summer	25.865	0.365	61.5	1142.8	Flood Risk
120 min Summer	25.895	0.395	62.2	1241.1	Flood Risk
180 min Summer	25.899	0.399	62.2	1254.4	Flood Risk
240 min Summer	25.898	0.398	62.2	1249.5	Flood Risk
360 min Summer	25.889	0.389	62.0	1221.9	Flood Risk
480 min Summer	25.878	0.378	61.8	1183.6	Flood Risk
600 min Summer	25.864	0.364	61.5	1140.8	Flood Risk
720 min Summer	25.851	0.351	61.2	1096.4	Flood Risk
960 min Summer	25.815	0.315	60.4	981.4	Flood Risk
1440 min Summer	25.750	0.250	59.0	774.6	Flood Risk
2160 min Summer	25.671	0.171	57.2	524.4	O K
2880 min Summer	25.612	0.112	56.0	343.7	O K
4320 min Summer	25.552	0.052	54.7	157.7	O K
5760 min Summer	25.541	0.041	45.0	125.2	O K
7200 min Summer	25.535	0.035	37.9	105.4	O K
8640 min Summer	25.530	0.030	32.9	91.0	O K
10080 min Summer	25.527	0.027	29.1	80.4	O K
15 min Winter	25.808	0.308	60.2	960.2	Flood Risk
30 min Winter	25.862	0.362	61.4	1131.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	162.544	0.0	25
30 min Summer	97.903	0.0	39
60 min Summer	58.969	0.0	66
120 min Summer	35.518	0.0	122
180 min Summer	26.403	0.0	166
240 min Summer	21.393	0.0	196
360 min Summer	15.903	0.0	262
480 min Summer	12.885	0.0	332
600 min Summer	10.945	0.0	400
720 min Summer	9.579	0.0	468
960 min Summer	7.646	0.0	604
1440 min Summer	5.565	0.0	864
2160 min Summer	4.051	0.0	1232
2880 min Summer	3.233	0.0	1568
4320 min Summer	2.335	0.0	2208
5760 min Summer	1.854	0.0	2936
7200 min Summer	1.550	0.0	3672
8640 min Summer	1.339	0.0	4360
10080 min Summer	1.183	0.0	5056
15 min Winter	162.544	0.0	25
30 min Winter	97.903	0.0	39

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
60 min Winter	25.913	0.413	62.6	1300.5	Flood Risk
120 min Winter	25.953	0.453	63.4	1430.4	Flood Risk
180 min Winter	25.963	0.463	63.7	1461.6	Flood Risk
240 min Winter	25.959	0.459	63.6	1451.5	Flood Risk
360 min Winter	25.947	0.447	63.3	1411.2	Flood Risk
480 min Winter	25.929	0.429	62.9	1352.9	Flood Risk
600 min Winter	25.909	0.409	62.5	1284.8	Flood Risk
720 min Winter	25.887	0.387	62.0	1212.7	Flood Risk
960 min Winter	25.832	0.332	60.8	1037.5	Flood Risk
1440 min Winter	25.735	0.235	58.6	726.4	Flood Risk
2160 min Winter	25.621	0.121	56.2	371.3	O K
2880 min Winter	25.555	0.055	54.8	167.3	O K
4320 min Winter	25.538	0.038	41.2	114.8	O K
5760 min Winter	25.530	0.030	32.9	91.0	O K
7200 min Winter	25.525	0.025	27.5	76.4	O K
8640 min Winter	25.522	0.022	23.6	66.6	O K
10080 min Winter	25.519	0.019	20.9	58.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
60 min Winter	58.969	0.0	66
120 min Winter	35.518	0.0	122
180 min Winter	26.403	0.0	176
240 min Winter	21.393	0.0	226
360 min Winter	15.903	0.0	282
480 min Winter	12.885	0.0	360
600 min Winter	10.945	0.0	436
720 min Winter	9.579	0.0	510
960 min Winter	7.646	0.0	652
1440 min Winter	5.565	0.0	918
2160 min Winter	4.051	0.0	1272
2880 min Winter	3.233	0.0	1532
4320 min Winter	2.335	0.0	2208
5760 min Winter	1.854	0.0	2984
7200 min Winter	1.550	0.0	3672
8640 min Winter	1.339	0.0	4416
10080 min Winter	1.183	0.0	5144

Model Details

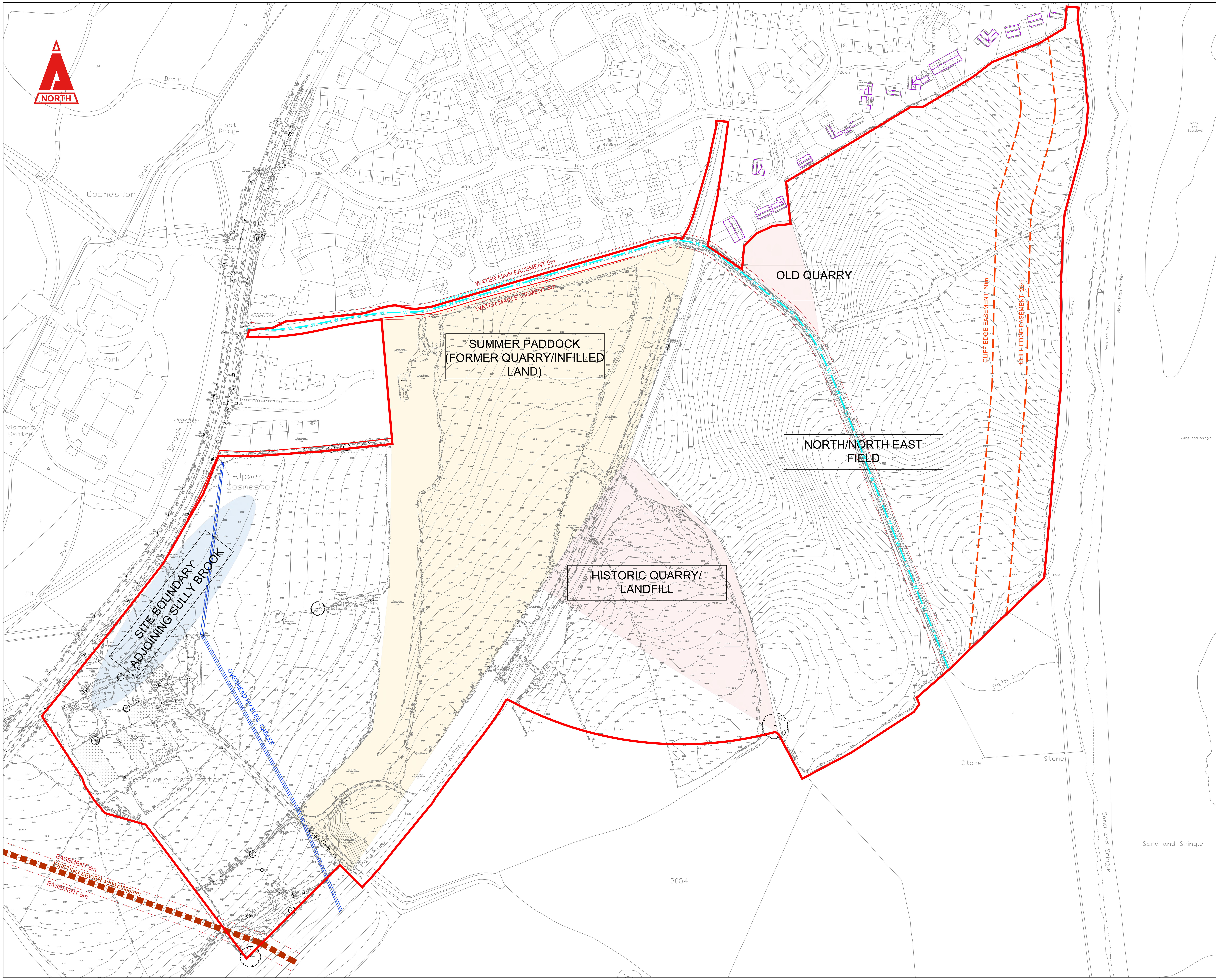
Storage is Online Cover Level (m) 26.000

Infiltration Basin Structure

Invert Level (m) 25.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.12762 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.12762

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	3023.0	0.700	0.0	1.400	0.0	2.100	0.0
0.100	3081.8	0.800	0.0	1.500	0.0	2.200	0.0
0.200	3141.1	0.900	0.0	1.600	0.0	2.300	0.0
0.300	3201.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	3261.4	1.100	0.0	1.800	0.0	2.500	0.0
0.500	3322.4	1.200	0.0	1.900	0.0		
0.600	0.0	1.300	0.0	2.000	0.0		

APPENDIX G – Site Constraints Plan



DO NOT SCALE FROM THIS DRAWING.

CONTRACTORS MUST CHECK ALL DIMENSIONS ON SITE. ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. DISCREPANCIES MUST BE REPORTED IMMEDIATELY TO CAMBRIA CONSULTING LIMITED BEFORE PROCEEDING.

THE CONTRACTOR IS TO REFER TO THE SPECIFICATION, FULL SCHEDULE OF RESIDUAL RISKS IN THE CONTRACT DOCUMENTATION AND ALSO TO INFORMATION FROM OTHER DESIGNERS, IN PARTICULAR THE M&E CONSULTANT REGARDING EXISTING LIVE SERVICES.

THIS SYMBOL IS USED TO HIGHLIGHT INSTANCES OF RISK WITHIN THE CONSTRUCTION PROCESS.

ALWAYS CHECK FOR LATER REVISIONS OF THIS DRAWING.

Rev.	Description	By	Chk	App
P03	SITE BOUNDARY AMENDED 29/08/19	CP	WJ	WJ
P02	EXISTING WATER MAIN ROUTE ADDED 29/03/19	CP	WJ	WJ
P01	FIRST ISSUE FOR COMMENT	SB		

Client:

Austin-Smith:Lord

Project:

UPPER COSMESTON FARM

Drawing Title:

CONSTRAINTS PLAN

Drawing No.

CC1857	CAM	ZZ	XX	SK	C	90	0105
Project No.	Org.	Vol.	Level	Type	Dis.	Class	No.

Suitability Status:	Scale @A1:	Rev:
PRELIMINARY	1:1250	P03

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APPENDIX H – NRW FRAP Response

Callum Parker

From: Llewellyn, Carl <Carl.Llewellyn@cyfoethnaturiolcymru.gov.uk>
Sent: 05 June 2019 12:51
To: Callum Parker; Enquiries

Subject: RE: Cosmeston

Afternoon

If the following conditions can be met then the works can be excluded and will not need a FRAP

Activity description: The construction of small outfall pipes and headwalls to main rivers.

Types of activity you can carry out: Creating a small headwall.

Types of activity you cannot carry out: Creating any structure that encroaches within the cross sectional profile of the existing channel.

Key conditions

You should not do any more than this exemption allows otherwise you will not be exempt.

Spatial conditions

The activity is not carried out in or within 100m of a main river that is classified high morphological status.

The activity is not carried out in or within a 200m radius to the following designation sites: - Special Protection Area (SPA); - Special Area of Conservation (SAC); - Ramsar site; - Sites of Special Scientific Interest (SSSI); - National nature reserve; - Local nature reserve.

The headwall is not located within 50 metres of any other man-made structure on or in the main river.

The works do not have a significant adverse effect on species included in a list published by the Secretary of State under section 41 of the Natural Environment and Rural Communities Act 2006 or by Welsh Ministers under section 42 of that Act that are not protected species.

The works do not occur in, or within 200 metres upstream of, a type of habitat included in a list published by the Secretary of State under section 41 of the Natural Environment and Rural Communities Act 2006 or by Welsh Ministers under section 42 of that Act.

The headwall is not within 8 metres of a flood defence structure or river control works;

The outfall pipe does not pass through or under any culvert, remote defence, river control works, sea defence or any raised embankment or wall forming part of the bank of the main river.

Any pipe that discharges through the headwall does not pass within 8 metres of a flood defence structure.

Design conditions

In the case of a headwall to a non-tidal main river, the outfall pipe is aligned to an angle of between 30° and 60° to the direction of flow in the river.
The diameter of the outfall pipe is less than 300mm.

The height of the headwall is no more than 1.5 metres or no more than 75% of the height of the bank, whichever is less.

The total length of bank affected during construction of the headwall is no more than 1.5 metres;

The headwall, wing walls and apron do not project beyond the existing line of the bank prior to work being carried out;
All excavated material not re-used on the site of the works must be removed from the banks and/or floodplain;

This exemption does not cover any temporary works needed for construction. Before registering for this exemption, you should contact your local NRW office to discuss if a bespoke permit might be needed for any temporary works required during the construction phases of the project.

Before registering for this exemption, we advise you consider the following:

The need for any temporary works to undertake this activity. If you need to use temporary works (including scaffolding and cofferdams) to undertake this activity, before registering, you should contact your local NRW office to discuss if a bespoke permit might be needed.

Regards

Eich Enw/ Carl Llewellyn
Teitl swydd/ Dadansoddiad Risg Llifogydd / Flood Risk Analysis
Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn/Tel: 03000 653092
E-bost/E-mail:
Carl.Llewellyn@naturalresourceswales.gov.uk

From: Callum Parker <c.parker@cambria.co.uk>
Sent: 04 June 2019 16:21
To: Enquiries <enquiries@cyfoethnaturiolcymru.gov.uk>
Cc: Llewellyn, Carl <Carl.Llewellyn@cyfoethnaturiolcymru.gov.uk>
Subject: Cosmeston

Good Afternoon,

I am enquiring about Sully Brook adjacent Cosmeston Lakes, CF64 5UB, Sully Brook is identified as a Main River on your flood risk maps. We are developing a site the other side of Lavernock Road and are in the process of a SuDS Pre Application with the SAB (Vale of Glamorgan).

The principles of surface water discharge to the nearest watercourse, Sully Brook, have been accepted by the SAB, however they advised that NRW would need to be contacted regarding the mode of connection to Sully Brook as it is designated a Main River. I assume we would need to apply for a Flood Risk Activity Permit to install an outfall to Sully Brook but want to confirm if there is a requirement as the outfall pipe would likely be no greater than 375mm diameter, as the pipe size is relatively small would the outfall be permit exempt?

Kind Regards,

Callum Parker

EngTech MICE
Infrastructure Associate

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