PROPOSED WIND TURBINE DEVELOPMENT ON LAND AT DUBBERS, NANPEAN, ST. AUSTELL, CORNWALL

FLOOD RISK ASSESSMENT

J-4142 -Rev

Engineering & Development Solutions

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FLOOD RISK ASSESSMENT

Report No.	Issue Detail	Originator	Date	Checked by	Date
J-4142	01	JM	28/10/2025	TPS	28/10/2025

For: Clean Earth Energy
Unit 2A Bess Park Road
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Job No: J-4142
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Edition: 01

CONTENTS

APPENDICES

1.0 INTRODUCTION

Clean Earth Energy are proposing to develop a site in Dubbers on land within the China Clay works area near St. Austell. It is proposed to provide two wind turbines with associated infrastructure at the above location. The site location lies north west of the Blackpool China Clay extraction pit. The site lies directly north of Greensplat Road, as seen on **Figure 1**, below. An aerial view of the site is included in **Figure 2**.

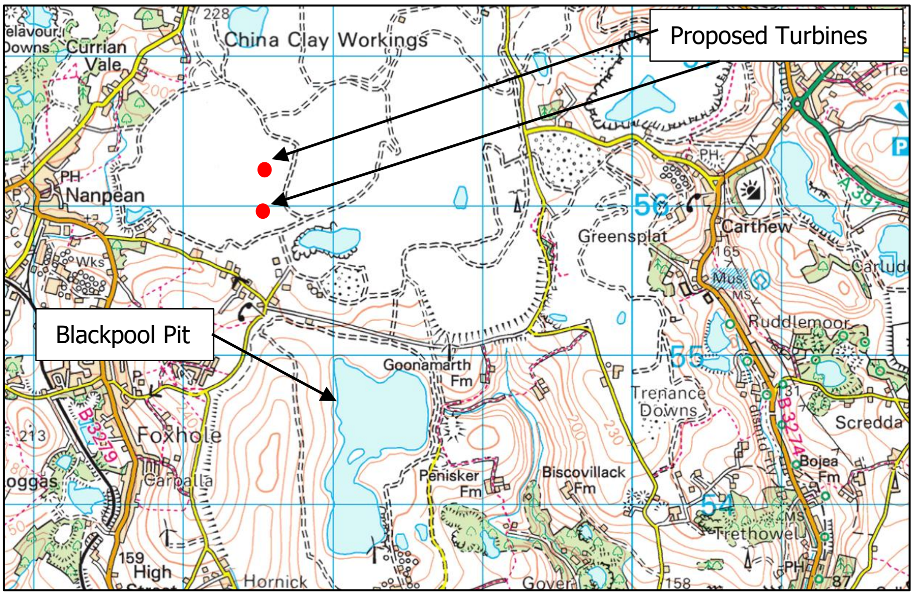


Figure 1: Geographical Area and Location

Figure 2: Aerial View of the Site

Reference to the Environment Agency (EA) flood map for planning shows the site to lie within Flood Zone 1 (Low risk, less than 1 in 1000 annual probability of river and sea flooding). As the development site is over 1 ha, it is required to provide a Flood Risk Assessment (FRA) in accordance with the National Planning Policy Framework (NPPF) on Planning and Flood Risk.

As the site lies within Flood Zone 1, the primary aim of the FRA will be to ensure that the development does not increase flood risk elsewhere. This can be achieved by providing a suitable sustainable drainage scheme (SuDS) that manages surface water runoff from the development.

To address this requirement, Engineering and Development Solutions (EDS) have been commissioned to prepare an FRA including a surface water drainage strategy for the proposed development, in accordance with the best practice principles of SuDS, the National Planning Policy Framework (NPPF), Sustainable Drainage Systems (SuDS), Guidance for Cornwall and Planning Practice Guidance (PPG). This report details the findings of the study.

2.0 SITE LOCATION & DESCRIPTION

2.1 Site Location

The proposed development site is located within the Old Pound China Clay mining area to the north west of the town of St. Austell, Cornwall. The site is approximately 4.5km from the town centre of St. Austell. The ordnance survey grid reference for the centre of the proposed site is SW 97576 56267.

Access to the site will be form the north off a private road, which meanders to the north via haul road which eventually joins Greensplat road to the north east

In terms of existing topography, the site has a high point of 271m AOD and generally falls in a westerly and south westerly direction towards the old Dubbers Mica Mine. Land to the south west of this fall gently to the village of Nanpean which is located about 1km away.

2.2 Existing Usage

The site is a former clay works and disused Mica Mine.

2.3 Proposed Usage

The development proposal is for the installation of two wind turbines with associated foundations, substation building and hardstanding area. The proposed layout which includes LIDAR ground profile information is shown in **Appendix A.**

3.0 HYDROLOGICAL AND HYDROGEOLOGICAL CONTEXT

3.1 Hydrology

The local hydrology around the site is influenced largely by the former china clay workings around the site, with several unnamed watercoures at the base of these features. These watercourses would be the natural receptor for surface water runoff generated by the site.

The unnamed watercourses follows the grounds profile and falls to the west towards the village of Nanpean; a system of open channels and culverts pass though the village before a confluence with the River Fal.

The general arrangement of the local hydrology is further described within **Figure 3** below.

It is therefore evident that runoff from the site will ultimately drain into the unnamed watercourse and then into the River Fal as shown in the figure below.

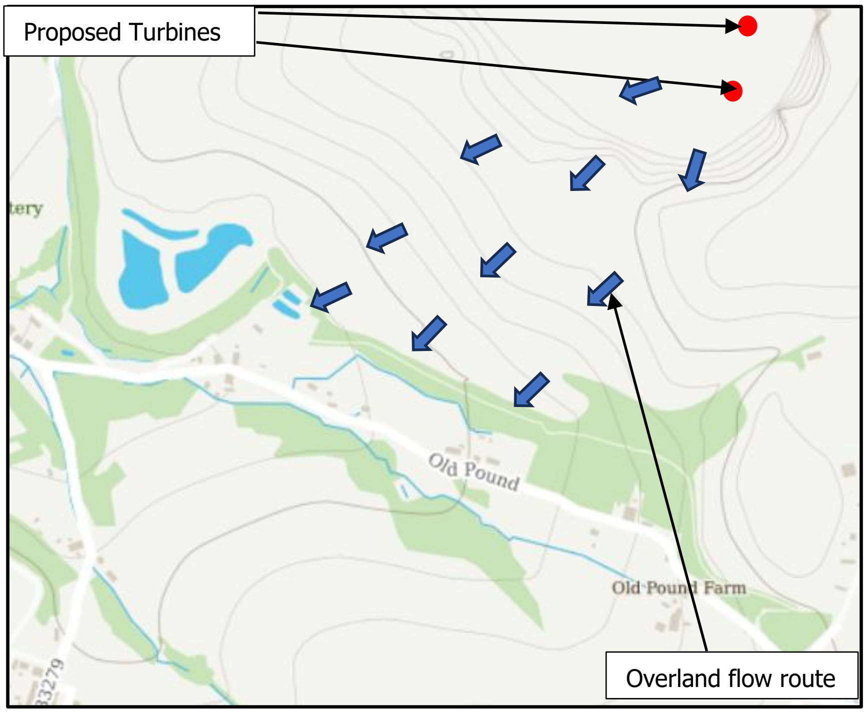


Figure 3 - Plan Showing Local Hydrology and Flow Routes

The catchment area at the downstream extent of the site is approximately 3.88km². The approximate catchment area can be seen in **Figure 4**, below. The catchment has been modified by human intervention with the presence of china clay quarrying and processing activities in the catchment area.

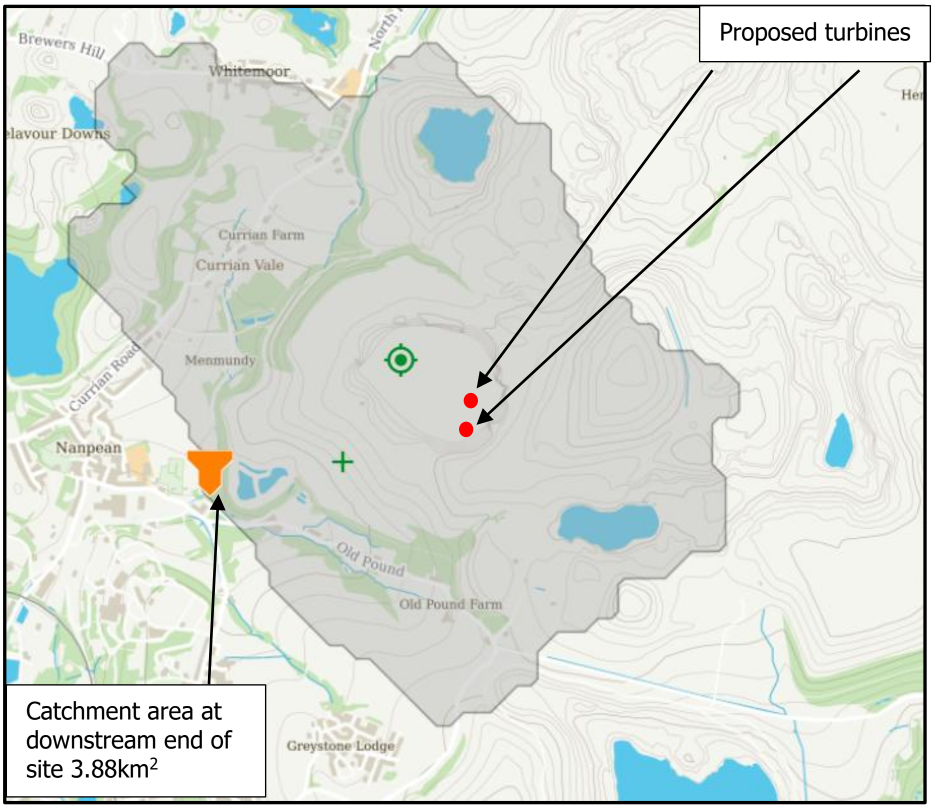


Figure 4 - Plan Showing Catchment at Downstream End of Site

3.2 Hydrogeology

Reference to information published by the British Geological Society (BGS) indicates that the site is underlain by an igneous intrusion which is commonly known as the St. Austell Intrusion, which is predominantly granite bedrock, see **Figure 5**, below. The BGS Geology of Britain mapping describes the bedrock as follows: '*Igneous bedrock formed between 358.9 and 252.2 million years ago during the Carboniferous and Permian periods*.' The local environment is dominated by intrusions of silica-rich magma. Additionally, to the west of the site, at the location of the site is dominated by superficial deposits. This is predominantly made up of alluvium, including clay, silt, and gravel. These were formed between 11.8 thousand years ago up to the present day, during the Quaternary period. This is unconsolidated detrital material deposited from running water in the unnamed watercourses, resulting in soft to firm consolidated layers of clay, silt, sand, and gravels.

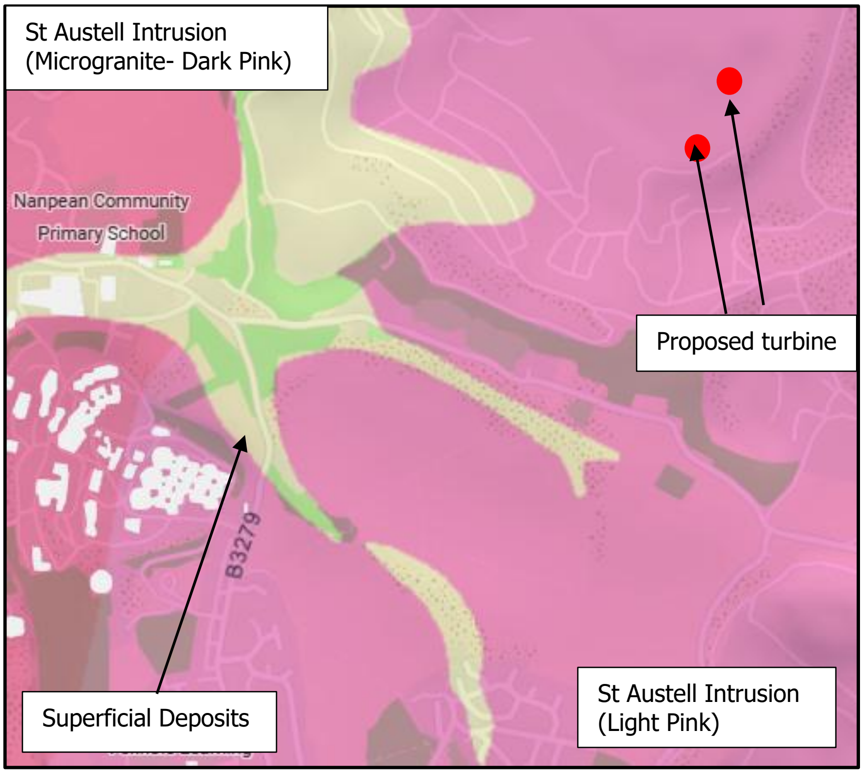


Figure 5 Plan Showing the Bedrock in the Surrounding Area

The area is designated as a "Secondary A" Aquifer type, which is the general designation for most of Cornwall. This is described as permeable layers that can support local water supplies and may form an important source of base flow to rivers (**Figure 6**).

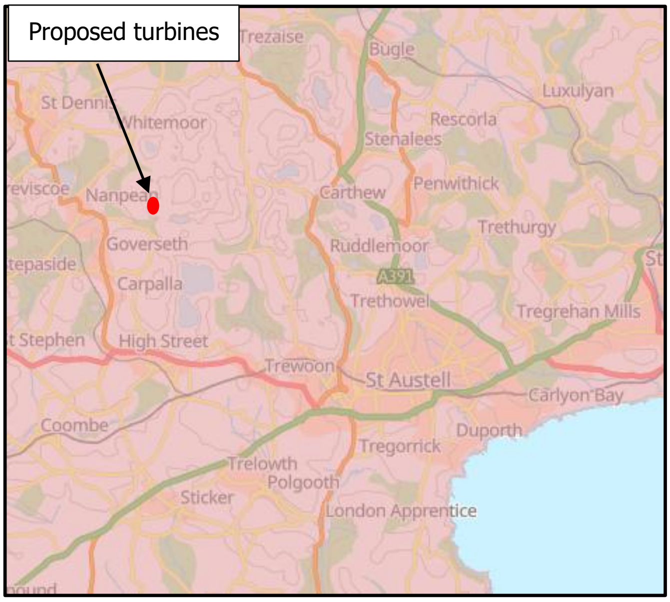


Figure 6 – Aquifer Designation map

With respect to Groundwater Vulnerability, the area is classified as 'High'. This is a measure of the vulnerability of groundwater to a pollutant discharged at ground level based upon hydrological, geological, hydrogeological and soil properties within the area.

A search has been undertaken with respect to borehole information available on the BGS database to determine groundwater depths in the vicinity of the site. **Figure 7** shows a map of the available boreholes in the surrounding area to the site. As shown, one borehole is referenced as SW95SE12 in a small, flooded clay pit to the southeast of the site.

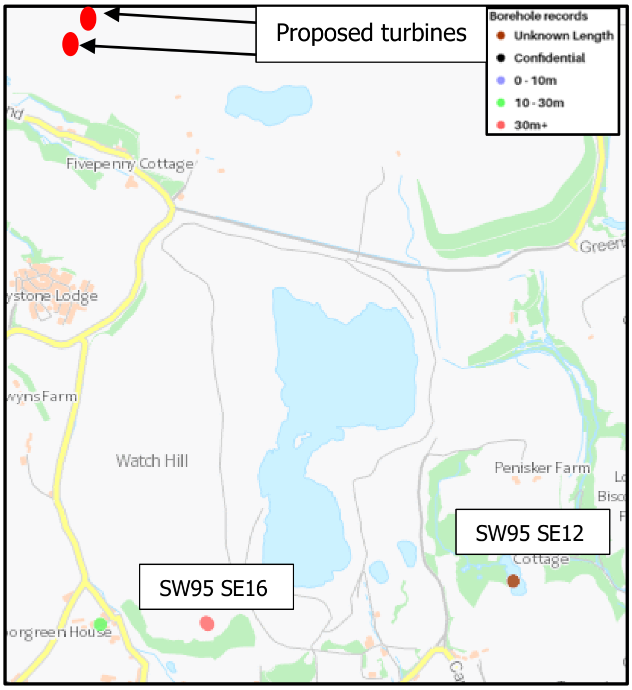


Figure 7 Plan Showing Borehole Records for the Site

Reference to the available information on the BGS website indicates that this is an observation well only and not a borehole. The note states that the feature is a dis-used water supply resource at approximately 500ft elevation (152m AOD) from which water was piped under gravity to a reservoir near Trenance on the 400ft (120m AOD) contour.

There is another borehole to the south of the site, and is referenced as SW95S16, located on Watch Hill. The borehole was cored to a depth of 108ft below ground level and found no standing water.

Groundwater levels on site are likely to be impacted by the dewatering activities undertaken at the adjacent Blackwater Pit which would act as a sump to draw down groundwater levels beneath the site.

The water surface level in the Blackwater pit sits at an elevation below 170m AOD. The water surface elevation in the flooded pit near the borehole referenced SW95SE12 sits at a level of approximately 155m AOD. As such, it is anticipated that the groundwater levels on the site will be somewhere between these two levels at an estimated elevation of approximately 160m AOD. The ground level at the site is approximately 210m AOD, so it is therefore apparent the groundwater should be well depressed beneath the ground surface.

4.0 ASSESSMENT OF FLOOD RISKS

4.1 Fluvial and Tidal Flooding

The Environment Agency indicative flood map for planning (**Figure 8**, below) shows that the entire site is located in Flood Zone 1, less than a 1 in 1000 annual probability of river and sea flooding) and is therefore not at significant risk from either fluvial or tidal flooding.

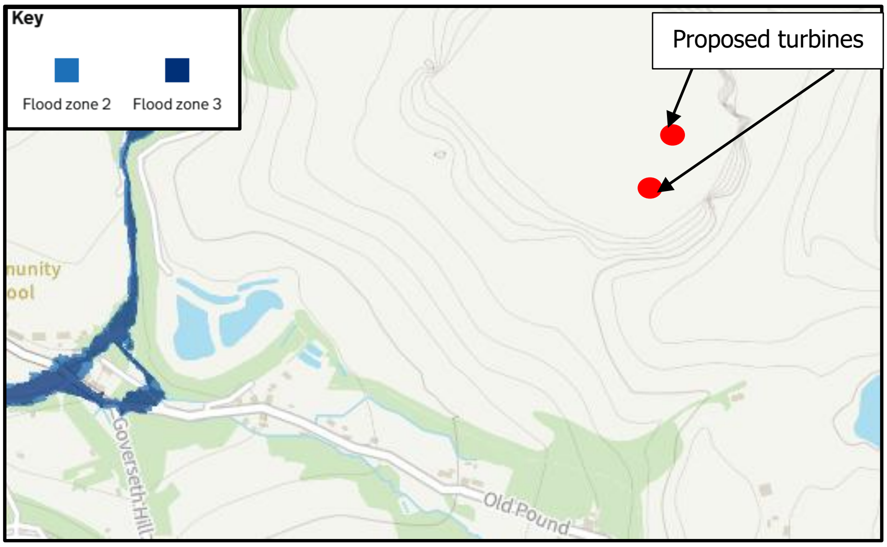


Figure 8 - Environment Agency Flood Map for Planning (Rivers & Sea) Extract

4.2 Groundwater Flooding

Groundwater flooding is linked to the ability of the ground to hold water. The Cornwall Level 1 Strategic Flood Risk Assessment (SFRA) notes the following about groundwater flooding in Cornwall:

"Groundwater flooding is linked to the ability of the ground to hold water. Due to its geology, Cornwall has only minor aquifers and generally does not experience much groundwater type flooding. The exception to this is found in areas that have extensive mine drainage systems, where blockages within drainage tunnels can lead to unexpected breakout of groundwater at the surface."

In addition, inspection of available information suggests that the groundwater table is depressed at considerable depth beneath the site.

The development proposal is to install two wind turbines and a new access track to the turbines linking with an existing trackway serving the China clay extraction operations . The presence of water in the clay pit adjacent to the site provides an indication of possible groundwater levels in the area. As such, construction for the proposed wind turbine is likely to be well above the phreatic surface and is unlikely to interact with groundwater flows. Therefore, the risk of groundwater flooding or impact of the proposed works on the groundwater regime is considered to be low and is not examined any further in this report.

4.3 Overland Flow

The proposed turbines are located on relatively high ground within the boundary of the site. As this is located on a higher ridge near The Great Longstone clay works which has numerous vegetated areas to limit overland flow, the potential for surface water accumulating at this point is limited. In addition to this, the ground slopes towards the Dubbers mine. As such, there is minimal potential for surface water to run towards the proposed turbine.

The EA map extract, **Figure 9** below, provides further assessment of the risk of flooding from surface water to the site. It shows that the site of the turbine is at a very low risk of flooding from surface water.

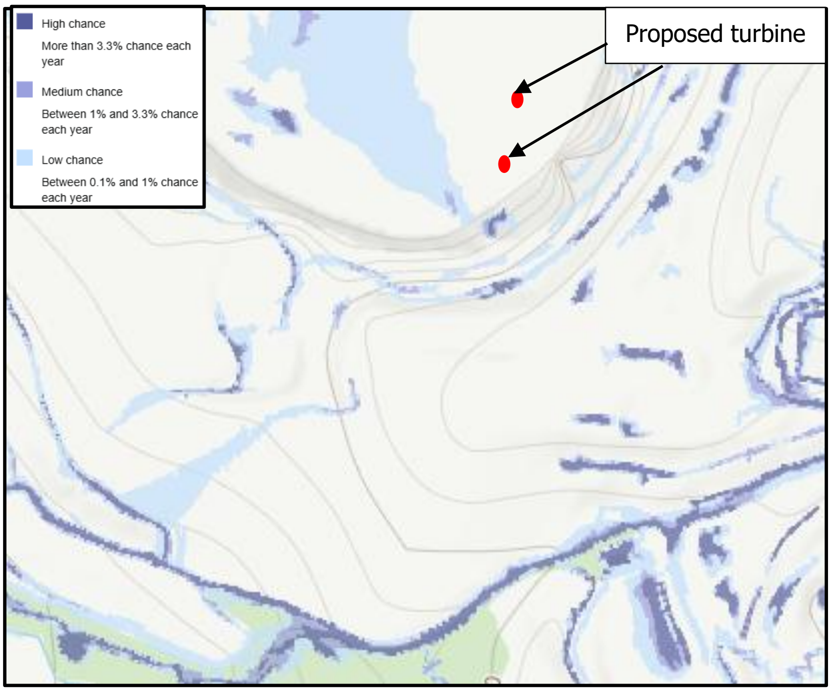


Figure 9 - EA Flood Risk from Surface Water Map Extract

The EA flood risk map does not indicate any signs of overland flow suggesting that the risk of surface water flooding doesn't threaten any sensitive elements of the development. Therefore, flooding from surface water is not considered to represent a significant risk to the development.

4.4 Flooding from Sewers

There are no mains sewers in the area and the nearest residential dwelling that lies upstream, is 1km west of the development. As such, the likelihood of flooding from sewers is negligible.

4.5 Flooding from Reservoirs, Canals, and Other Artificial Sources

Interrogation of the online EA flood risk mapping service does not indicate the site is at risk of flooding from reservoirs.

Considering local bodies of water associated with the China clay extraction activities, it is apparent that the water level within Blackpool Pit is at a significantly lower elevation than the site and escape of water from this pit would not represent a flood risk to the site.

Therefore, flooding of the site from reservoirs and other artificial water bodies is not considered to be a significant risk.

4.6 Flooding as a Result of Development

The development of the site will alter the nature of the surface permeability across the site through the implementation of the hardstanding and access track.

It is important that surface water runoff from the development is understood and managed by means of a sustainable surface water drainage system to prevent an increase in the risk of flooding to areas downstream of the site.

By designing the site's surface water drainage infrastructure in accordance with the advice reproduced in **Section 5**, the proposed development will not increase flood risk to third parties downslope. In consideration of the above, the proposed sustainable drainage system to be installed within the development is described in more detail in **Section 6** of this report.

5.0 DESIGN STANDARDS

Design of the site drainage infrastructure and Sustainable Drainage System (SuDS) is to be carried out in line with best practice, and to industry standard design procedures. Several publications, including design guidance and best practice guidance will be applied to different components of the final SuDS infrastructure. The sections below provide an overview of the design standards to be used on this project for various aspects of the SuDs infrastructure design.

5.1 The CIRIA SuDS Manual (C753)

This document is a comprehensive publication covering design, construction, operation, and maintenance of SuDS. The advice and best practice outlined in this document has been utilised in the design of the site SuDs features which have been detailed in this report.

5.2 Building Regulations Part H

Building Regulations Part H 'Drainage and Waste Disposal' covers the design and installation of surface water and foul water systems. All private drainage including pipes, manholes, down pipes, and other drainage infrastructure on the site should be designed and installed in accordance with this document.

5.3 The Wallingford Procedure

Developed by HR Wallingford, this publication covers the design of urban drainage systems. In addition, the document includes regional rainfall data for use in design for varying return period events. Basic sizing calculations for the proposed SuDS system and the estimation of the runoff volumes have been made using this method.

5.4 National Planning Policy Framework

The National Planning Policy Framework (NPPF) contains a policy relating to the appropriate assessment of flood risk within the UK. The associated technical guidance provides further details on the definitions, classifications and constraints used to apply national policy to new developments.

It contains details on flood zone definition, site specific FRAs, vulnerability classifications, appropriate development, climate change allowances, residual risk management, flood resilience, the sequential test, and the exception test.

5.5 Drainage Guidance for Cornwall

This document provides advice for Cornwall Council as the Local Planning Authority and those involved in developing the built environment on:

- The location of Critical Drainage Areas, where the flood risks from surface water runoff are likely to be most significant.
- Standards to be achieved by surface water drainage.
- The content of a FRA considering surface water drainage.
- Sustainable Drainage techniques (SuDS)
- Sources of further information

The Drainage Guidance for Cornwall (DGfC) document is currently under review though until an updated version is published, advice appropriate to the proposed development considered within this report is reproduced below for ease of reference.

6.0 PROPOSED SUSTAINABLE DRAINAGE SYSTEM (SUDS)

The preferable drainage solution would be to drain all surface water runoff from the development using infiltration, in line with best practice guidance to deal with runoff as close to source as possible. Due to the site's location in the china clay mining area, it is unlikely that infiltration would work effectively due to the high clay content in the subsoil. Therefore, an attenuation-based drainage system is proposed for the development.

6.1 Drainage Design

The introduction of the hardstanding area and access track around the turbine will introduce semi-impermeable areas. This infrastructure is proposed to be installed as imported hardcore capped with Type 1 material. This will result in a partially permeable road and hardstanding area. As such, the hardstanding and access road spur will be calculated as being 50% permeable.

The foundation base to the turbine will be buried and will allow infiltration into the finished surfacing over the base. The footprint of the base is within the coverage of the hardstanding area, so it will be treated as being 50% permeable by default.

The following items detail the proposed impermeable area:

- Access road = 1960 x 50% = 980m²
- Hardstanding by turbine = 9640 x 50% = 4,820m²
- Roofs = 2,500m^2
- <u>Total Equivalent Impermeable Area = 8,300m² (0.830 ha)</u>

It is proposed to drain the above impermeable areas by means of a series of shallow swales laid along the lower perimeter of the hardstanding area and access road; these will convey flows to a surface detention basin constructed close by. Flow from the basin will be discharged into the local surface water environment (Unnamed Tributary).

This system will provide initial filtering of the site runoff during the construction phase and settlement in the detention basin to reduce the impacts of silt laden runoff on the watercourse downstream of the site.

MicroDrainage Software has been used to size the storage required to facilitate an impermeable area of 8,300m^2 with the discharge limited to greenfield run off rate of 10.3 l/s (QBar). These calculations are based on FEH rainfall and indicate a minimum basin size of 680.5m^3 to accommodate the worst-case design storm (100-year) with rainfall intensities increased by 50% to allow for the effects of climate change as required by Cornwall Council.

This volume of storage could be accommodated within an attenuation basin formed using a base area of 450m^2 with a base level of 256m AOD, a water depth of 1.2m and side slope of 1:3; If the upstream flow rate exceeds 10.3 l/s, the system would back up into the basin. The basin would ordinarily be dry during dry weather and would only fill with water during times of extreme rainfall.

A conceptual surface water drainage layout is included as Drawing 3001 in **Appendix A.** The detention basin has been sized using MicroDrainage; calculations are included in **Appendix B**.

6.2 Exceedance Events

In the unlikely event of a storm in excess of the 1 in 100-year return period rainfall event occurring (including climate change allowance), or if the proposed drainage systems were to become blocked, water may flood the system. In this case it is considered that the overflowing water would run over ground in a westerly and south westerly direction from the site where it would be intercepted by the existing watercourse as per the pre-developed scenario. Exceedance flow direction arrows are shown on the drawings.

Due to the storage provided in the proposed drainage systems, and design standard used (1 in 100-year storm with an additional 50% allowance for the effects of climate change), any exceedance flows would be lower than would flow off the site in the pre-development scenario for a similar storm event.

6.3 Maintenance

The proposed surface water drainage systems will remain private and will not be offered for adoption. Management and maintenance responsibility for the infrastructure will be the responsibility of the site owner/operator.

Maintenance activities for the systems will broadly comprise regular maintenance, occasional tasks, and remedial work where necessary, as per the guidance in the CIRIA SuDS Manual C753 which is summarised in **Table 1** below. Inspection of the surface water drainage systems can generally be undertaken during routine site visits e.g., for grass cutting, leaf collection and/or litter collection.

DETENTION BASIN AND SWALES		
Maintenance Activity	**Required Action**	**Typical Frequency**
Regular maintenance	Cut grass and verges surrounding basin/swales to allow for access	Monthly or as required (based on inspections)
	Clear upstream drainage features of debris	
	Inspect flow control device for blockages and remove any sediment in chamber	
Occasional maintenance	Remove sediment and debris from inlet and outlet to basin and swales	As required, based on inspections
Monitoring	Inspect swales and detention basin and note rate of sediment accumulation	Monthly in the first year then annually
	Check detention basin to ensure emptying is occurring	Annually

Table 1 – Detention Basin and Swales Typical Maintenance Activity Schedule

6.4 Residual Risks After Development

Rainfall over and above the design event could cause the sustainable drainage system to flood, however, any exceedance flows would be dealt with as outlined above.

The sustainable surface water drainage systems proposed in this report have been designed for the volume of surface runoff resulting from the proposed development, thus any unauthorised future connections into the proposed networks could potentially overload the system. Any future development on the site, beyond the current proposal, should be suitably planned and considered.

6.5 Construction Stage Drainage

In order to limit the potential for silt discoloured water to run off the site during the construction stage, it is proposed that the attenuation basin and swale collection system be constructed at the front end of the works. In this way any runoff from the subsequent construction of the hardstanding and turbine foundation may be intercepted by the SUDS system and provided with filtration and settlement within the conveyance swales and the attenuation basin.

During the construction phase, the impermeable area on site will increase due to the creation of temporary car parking and office units being placed on site. In order to mitigate the surface water runoff before completion, a line of silt fencing should also be installed downslope of the works area during the construction phase. Additionally, moveable straw bales should be provided at the lower end of the access track to allow interception and filtration of any runoff bypassing the SUDS system along the access.

7.0 SUMMARY AND CONCLUSIONS

This study has investigated mechanisms of flooding and the potential for Sustainable Drainage (SuDS) to be installed as part of the development of a wind turbine and associated infrastructure at Dubbers, Nanpean, St. Austell, Cornwall.

Environment Agency (EA) indicative flood mapping shows that the development site is located entirely within Flood Zone 1; at little or no risk from tidal or fluvial flooding and is therefore suitable for all types of development. The development proposal is for an area greater than 1 hectare in size, therefore further consideration of surface water drainage has been undertaken.

Additional investigation of the existing hydrology and hydrogeology has been undertaken at the request of Clean Earth Energy for completeness.

The study has investigated alternative mechanisms for flooding at the site and has concluded that the site is not at risk of flooding and will not cause any increase in flood risk elsewhere once the proposed sustainable drainage system is operational.

Due to the location of the site within the china clay quarrying area to the north west of St Austell, the use of infiltration for disposal of surface water has been ruled out. As such, a conceptual attenuation-based drainage system has been proposed and outlined for the site.

The attenuation system has been designed to the 100-year standard with a 50% allowance for climate change with a peak outlet rate equivalent to the greenfield runoff rate of 10.3l/s.

Proposals have been provided to mitigate against the escape of silty runoff water during the construction stage.

Provided the recommendations outlined in this report are adopted in the development proposal then there is the capacity to manage the surface water runoff from the development onsite. The proposed drainage infrastructure has been designed in accordance with guidance outlined in the NPPF, PPG, and Drainage Guidance for Cornwall and therefore the development is entirely appropriate on this site from a flood risk perspective.

APPENDIX A PROPOSED LAYOUT INCLUDING CONCEPTUAL SuDS PLAN

KEY

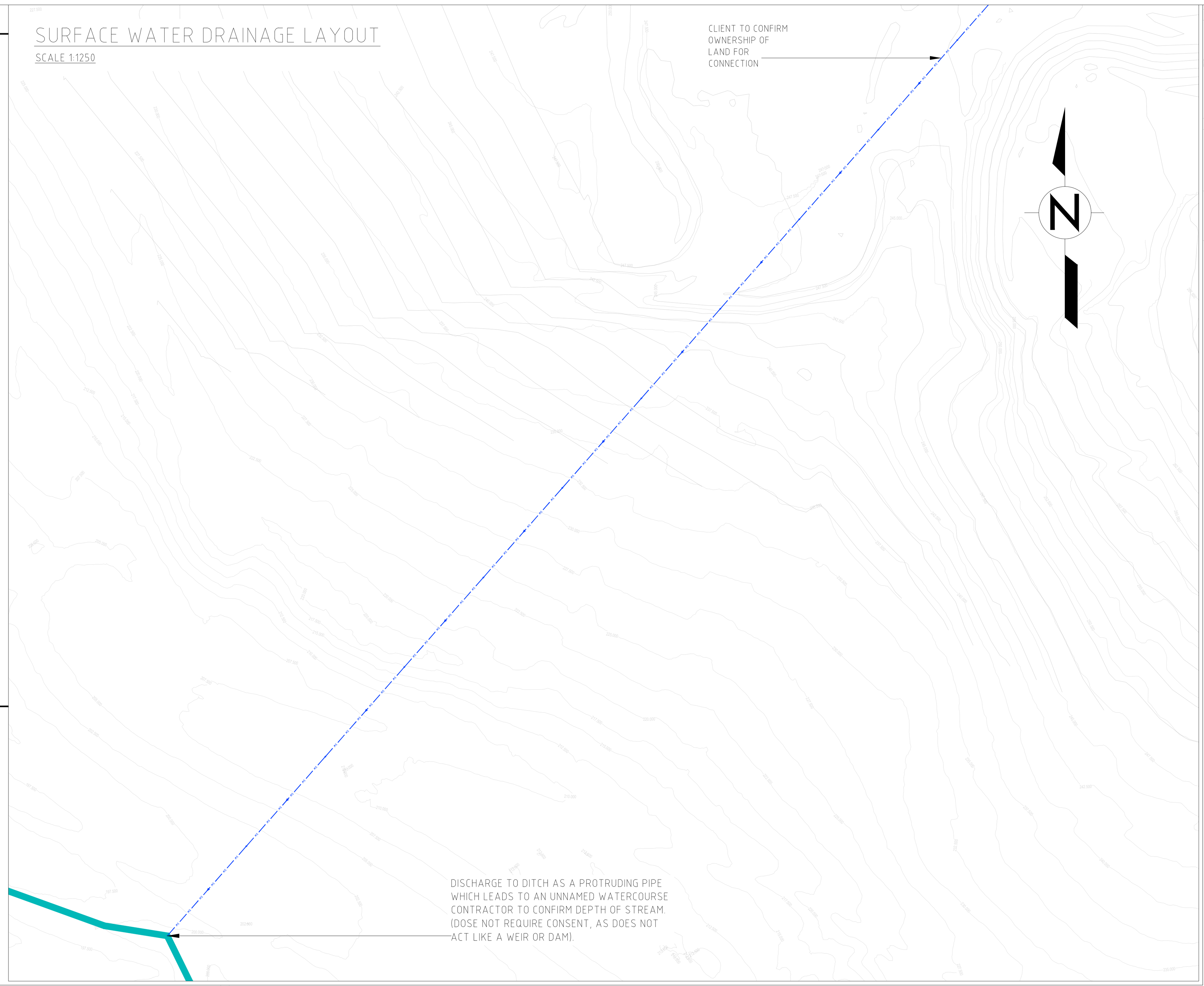
Symbol	Description
(red line)	SITE BOUNDARY
(teal line)	EXISTING DITCH
SW — SW —	PROPOSED PRIVATE SURFACE WATER DRAINAGE 150mm ø (UNLESS STATED)
	PROPOSED TORRENT GULLY
	PROPOSED CULVERT
	PROPOSED SWALES
	PROPOSED CATCHPIT WITH LEAF AND DEBRIS FILTER
	PROPOSED PRIVATE SURFACE WATER POLYPROPYLENE INSPECTION CHAMBER (475/600ø P.P.I.C.)
1 IN 100	DENOTE DIRECTION OF FALL OF FINISHED SURFACE
	FLOOD EXCEEDANCE ROUTES POST DEVELOPMENT
	PROPOSED LOADBEARING INFRASTRUCTURE
	PROPOSED LEVEL ACCESS TRACK

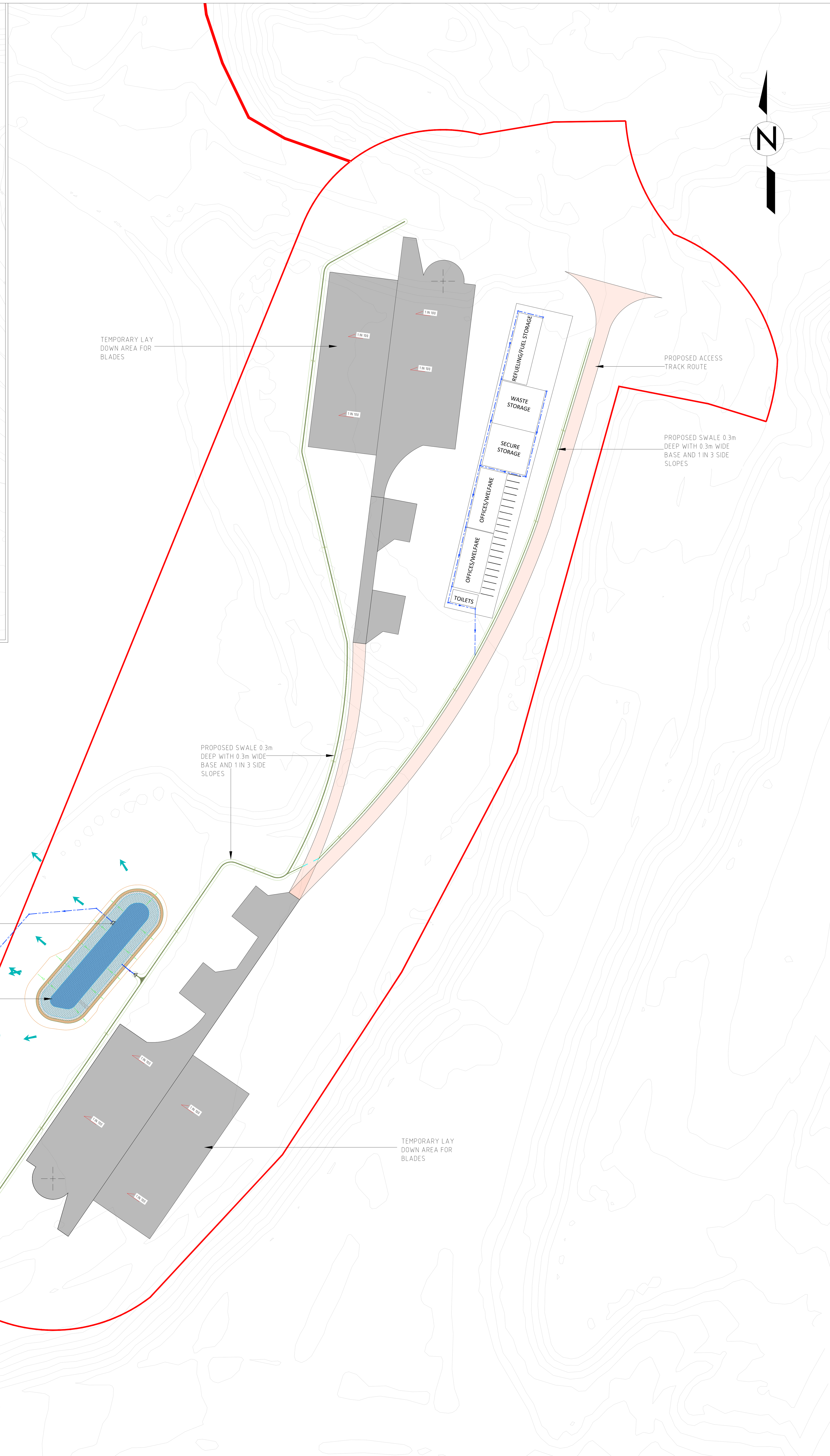
SURFACE WATER DRAINAGE

THE SURFACE WATER DRAINAGE SYSTEM HAS BEEN DESIGNED TO ACCEPT RUNOFF FROM THE PROPOSED HARDCORE ACCESS TRACK, AND HARDSTANDING AREAS . THE HARDCORE ACCESS TRACK AND HARDSTANDING AREAS ARE ASSUMED TO BE SEMI-PERMEABLE (50% PERMEABLE)

CONVEYANCE SWALES WILL DRAIN RUNOFF FROM THE SITE INTO AN ATTENUATION BASIN TO ALLOW FOR SETTLEMENT OF SILT LADEN RUNOFF. THE DETENTION BASIN HAS BEEN DESIGNED TO ACCEPT FLOWS FROM EVENTS UP TO AND INCLUDING THE 1 IN 100 YEAR STORM EVENT PLUS AN ALLOWANCE OF 50% FOR CLIMATE CHANGE.

THE DISCHARGE FROM THE BASIN WILL BE RELEASED AT A CONTROLLED RATE OF 10.3 l/s HAS BEEN USED. SURFACE WATER WILL BE DISCHARGED TO A TRIBUTARY OF THE GOVER STREAM. A HYDRO INTERNATIONAL HYDROBRAKE OR SIMILAR WILL PROVIDE THE NECESSARY FLOW CONTROL.





SURFACE WATER DRAINAGE LAYOUT
SCALE 1:1000

NOTES

1. This drawing is copyright. Refer to details above.
2. This drawing is only to be used for the purposes described in the status box below. Work to figured dimensions only, do not scale for construction purposes.
3. This drawing is to be read in conjunction with all other drawings, details and specifications pertaining to the work described. It should only be used for the purpose marked in the status box below, and shall not be used for construction unless clearly marked CONSTRUCTION.
4. Materials and workmanship shall comply to the appropriate British Standards and Codes of Practice unless otherwise stated.
5. The activities required to construct the work, shown on drawings clearly marked CONSTRUCTION, may be subject to the provisions of the Construction (Design & Management) Regulations 2015. The Contractor and Client must ensure that they are adequately conversant with these regulations and that the appropriate procedures required under the regulations are observed at all times.
6. The contractor is responsible for locating services prior to excavation. Any services shown on the drawing should be considered 'indicative' only. Where no services are shown on the drawing it does not necessarily mean there are no services present, only that a services search has not been undertaken. Where in doubt refer to HSE booklet "avoiding danger from underground services"
7. Design Risk Assessment

   A risk assessment relating to potential hazards associated with the works described within this drawing, in so far as they have been designed by EDS Ltd, has been undertaken. Risks identified have been eliminated by design wherever practicable. The status with regard to residual risks is as follows:

   The work is of low complexity with low level of risk; it is considered that there are no significant residual risks that would not be readily foreseeable by a competent contractor, observing good working practices.

   Designer - EDS Drawing revision - A
   Date - 22:10:25

CAUTION ! UNDERGROUND UTILITY SERVICES NOT SHOWN ON DRAWING

DATE	DRWN	CHKD	REV	NOTES
22.10.25	JM	TPS	A	PRELIMINARY ISSUE

PROJECT MANAGER :-	JAN CLARK
PROJECT ENGINEER :-	JOSHUA MUNAYRD
DRAWN DATE :-	OCT 2025
SCALE & SHEET SIZE :-	1:1000 @ A1

PRELIMINARY

Engineering & Development Solutions

- Flood Risk Assessment
- SuDS and Surface Water
- Foul and Sewage Treatment
- Highway Design
- Civil Engineering
- Statutory Approvals

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CLIENT
CLEAN EARTH ENERGY LTD.

PROJECT
DUBBERS WIND TURBINES

DRAWING TITLE
SURFACE WATER DRAINAGE LAYOUT

PROJECT No.	DRAWING No.	REV
J-4142	3001	A

KEY

SITE BOUNDARY

FLOOD EXCEEDANCE ROUTES

CONSTRUCTION PHASE SILT FENCE

OVERLAND FLOW

THE SITE IS LOCATED IN A POST INDUSTRIAL AREA IN THE CHINA CLAY WORKS, NORTHWEST OF THE TOWN OF ST AUSTELL.

OVERLAND FLOW FOR THE AREA HAVE BEEN HEAVILY ALTERED BY HUMAN ACTIVITY ON THE CLAY WORKS RESULTING IN A CHANGE OF OVERLAND FLOW ROUTES. THESES ROUTES AT PRESENT FLOW IN A WESTERLY DIRECTION.

POST DEVELOPMENT RUNOFF FROM IMPERMEABLE AREAS WILL BE DISPOSED OF INTO AN ATTENUATION SYSTEM, DESIGNED TO THE 100 YEAR + 50% CLIMATE CHANGE EVENT.

IN THE UNLIKELY EVENT OF A STORM IN EXCESS OF THE 1 IN 100 YEAR RAINFALL EVENT, OR IF THE DRAINAGE SYSTEM WERE TO BECOME BLOCKED, WATER MAY SURCHARGE THE SYSTEM. IN THIS CASE IT IS CONSIDERED THAT THE OVERFLOWING WATER WOULD BE CONVEYED DOWN THE SITE IN A WESTWARD FACING DIRECTION, AS PER THE PRE-DEVELOPMENT SCENARIO.

ANY EXCEEDANCE FLOWS WOULD BE LESS THAN FLOWS OFF THE SITE IN THE PRE-DEVELOPMENT SCENARIO FOR A SIMILAR STORM EVENT.

CONSTRUCTION QUALITY CONTROL PROCEDURE

CIRIA REPORT C753 'THE SuDS MANUAL' COVERS THE DESIGN AND INSTALLATION OF SURFACE WATER SYSTEMS. ALL PRIVATE DRAINAGE BASIN SWALES, INCLUDING PIPES, AND OTHER DRAINAGE INFRASTRUCTURE ON THE SITE WILL BE INSTALLED IN ACCORDANCE WITH THIS DOCUMENT.

TO ENSURE SATISFACTORY QUALITY OF CONSTRUCTION THE CLERK OF WORKS OR COMPETENT PERSON WILL BE INFORMED OF PROGRESS AND INVITED TO MAKE ROUTINE INSPECTIONS, AS AND WHEN AGREED BETWEEN THE DEVELOPER AND THE BUILDING INSPECTOR.

A SURFACE WATER DRAINAGE SYSTEM HAS BEEN DESIGNED TO DISPOSE OF SURFACE WATER RUNOFF FROM THE WORST CASE STORM WITH A 100 YEAR RETURN PERIOD WITH EXISTING RAINFALL INTENSITIES INCREASED BY 50% TO ALLOW FOR THE POTENTIAL EFFECTS OF CLIMATE CHANGE OVER THE LIFETIME OF THE DEVELOPMENT.

A DRAINAGE DESIGN HAS BEEN UNDERTAKEN FOR THE PROPOSED DEVELOPMENT. THE CONSTRUCTION OF THE DRAINAGE SYSTEM SHALL BE UNDERTAKEN IN STRICT ACCORDANCE WITH THIS DESIGN.

ONCE THE WORKS ARE COMPLETED MAINTENANCE MUST BE CARRIED OUT FOLLOWING BEST PRACTICE RECOMMENDATIONS.

CONSTRUCTION PHASE SURFACE WATER MANAGEMENT PLAN

CONSTRUCTION WORKS ARE TO TAKE PLACE IN SUCH AN ORDER THAT THE RISK OF POLLUTION AND OVERLAND FLOW INCIDENCES ARE KEPT TO A MINIMUM. CONSTRUCTION IS DUE TO START AS SOON AS POSSIBLE.

ANY FEATURES THAT ARE TO BE USED IN THE CONVEYANCE OF SURFACE WATER RUNOFF FROM UP SLOPE OF THE BASIN, I.E. SILT FENCES, ARE TO BE CONSTRUCTED FIRST. CONSTRUCTION RUNOFF IS HEAVILY LADEN WITH SILT, WHICH MUST NOT BE ALLOWED TO BLOCK OR CLOG THE INFRASTRUCTURE DURING SUBSEQUENT CONSTRUCTION PHASES.

A FILTER STRIP OF MINIMUM 1m SHOULD BE PROVIDED BETWEEN THE EDGE OF TURBINE STAGING AREA AND PROPOSED SWALE TO PROVIDE INITIAL FILTRATION OF CONSTRUCTION RUNOFF. SILT FENCES SHOULD BE INSTALLED PARALLEL WITH CONTOURS WHERE POSSIBLE TO PREVENT SILT LADEN RUNOFF DISCHARGING DIRECTLY TO THE SWALES.

THE SILT FENCING SHALL BE CONSTRUCTED FIRST AND THEN THE DETENTION BASIN AND SWALES . ALL DRAINAGE SHOULD BE CONSTRUCTED PRIOR TO ANY OTHER SITE ENABLING WORKS.

THE CONSTRUCTION PHASE DRAINAGE IS SHOWN ON THE ADJACENT PLAN. IN ADDITION, ALL WORKS WILL BE CARRIED OUT IN LINE WITH THE ENVIRONMENT AGENCY POLLUTION PREVENTION GUIDELINES.

FUTURE MANAGEMENT PLAN & MAINTENANCE OF THE SYSTEM

THE PROPOSED DRAINAGE SYSTEMS WILL REMAIN PRIVATE AND WILL BE OPERATED AND MAINTAINED BY THE SITE OWNER/USER.

REGULAR MOWING SHOULD BE DONE TO RETAIN GRASS LENGTH AND THE REMOVAL OF SEDIMENTS TO ENSURE THE EFFICIENCY OF THE SWALE.

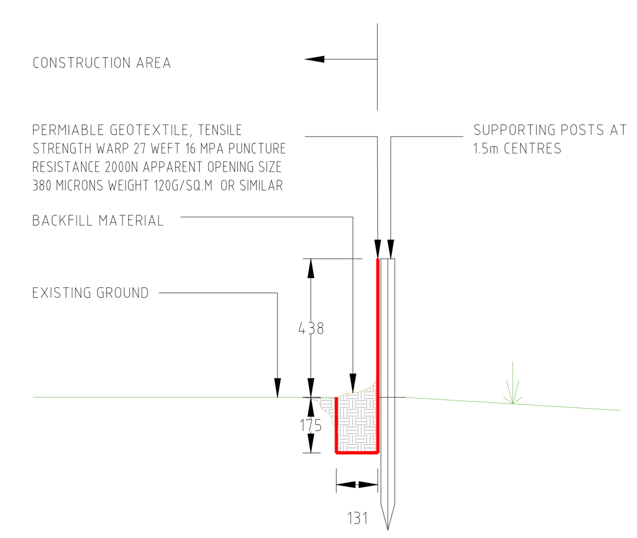
REGULAR INSPECTION AND CLEANING OF THE DRAINAGE INFRASTRUCTURE, INCLUDING THE OPEN SWALE, DOWN-PIPE, PIPE / GULLY NETWORKS, SHOULD BE CARRIED OUT FREQUENTLY TO PREVENT BUILD-UP OF SILT AND DEBRIS, WHICH WILL REDUCE THE SYSTEM CONVEYANCE CAPACITY. VISUAL INSPECTION SHOULD IDEALLY BE CARRIED OUT AFTER ANY HEAVY RAINFALL EVENT DURING THE FIRST YEAR OF OPERATION, THEN SIX-MONTHLY AFTER THAT. PARTICULAR ATTENTION SHOULD BE PAID DURING THE AUTUMN MONTHS WHEN LEAF LITTER AND OTHER DEAD PLANT MATERIAL MAY CAUSE OBSTRUCTION.

ANY ISSUES OR FAILURES IDENTIFIED WITH THE SYSTEM SHOULD BE RECTIFIED IMMEDIATELY BY A SUITABLE CONTRACTOR, OBSERVING SUITABLE WORKING PRACTICES AND FOLLOWING THE GUIDANCE AND PROCEDURES AS IDENTIFIED ABOVE.

CONSTRUCTION PHASE DRAINAGE PROCEDURE

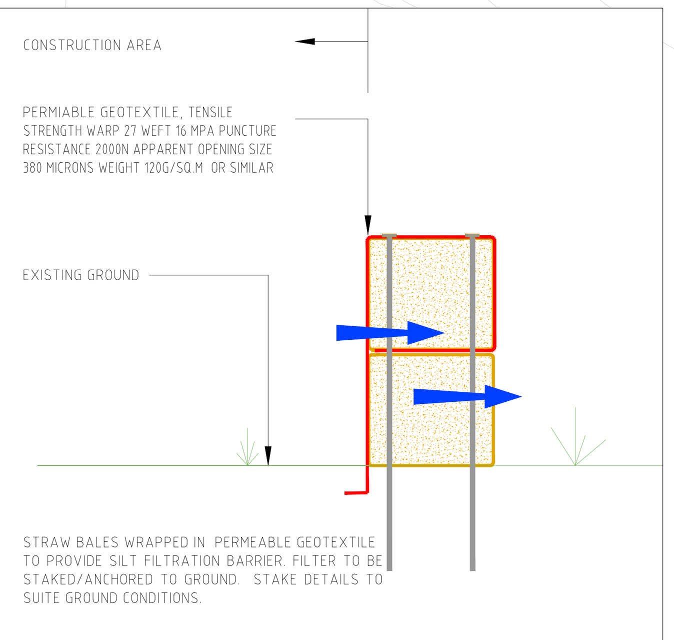
THE CONSTRUCTION PHASE DRAINAGE IS SHOWN ON THE ADJACENT PLAN. IN ADDITION, ALL WORKS WILL BE CARRIED OUT IN LINE WITH THE ENVIRONMENT AGENCY POLLUTION PREVENTION GUIDELINES.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required



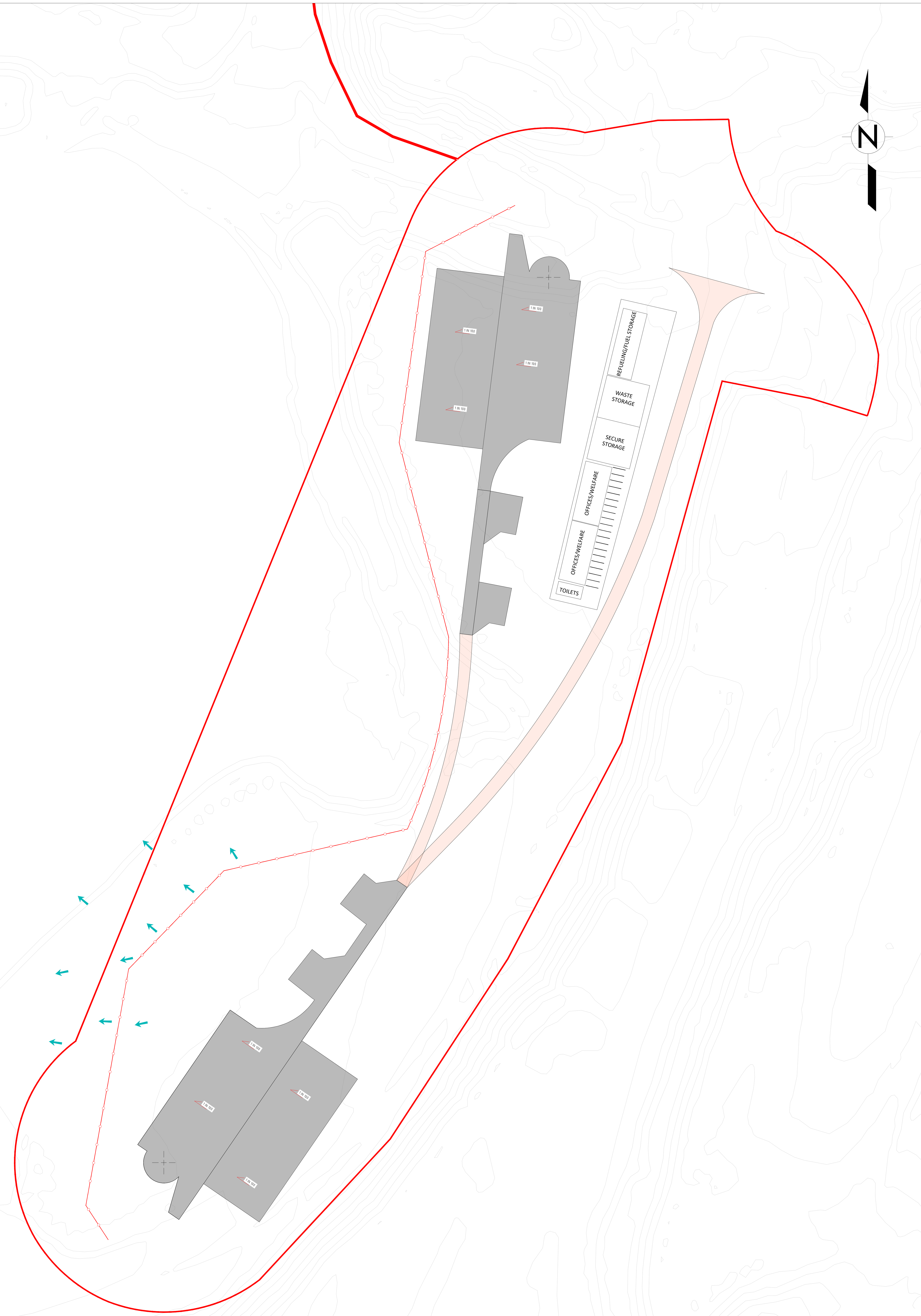
CONSTRUCTION PHASE SILT FENCE

1:20



CONSTRUCTION PHASE SILT FENCE ('NO DIG' AREA – IF REQUIRED)

1:20



NOTES

1. This drawing is copyright. Refer to details above.
2. This drawing is only to be used for the purposes described in the status box below. Work to figured dimensions only, do not scale for construction purposes.
3. This drawing is to be read in conjunction with all other drawings, details and specifications pertaining to the work described. It should only be used for the purpose marked in the status box below, and shall not be used for construction unless clearly marked CONSTRUCTION.
4. Materials and workmanship shall comply to the appropriate British Standards and Codes of Practice unless otherwise stated.
5. The activities required to construct the work, shown on drawings clearly marked CONSTRUCTION, may be subject to the provisions of the Construction (Design & Management) Regulations 2015. The Contractor and Client must ensure that they are adequately conversant with these regulations and that the appropriate procedures required under the regulations are observed at all times.
6. The contractor is responsible for locating services prior to excavation. Any services shown on the drawing should be considered 'indicative' only. Where no services are shown on the drawing it does not necessarily mean there are no services present, only that a services search has not been undertaken. Where in doubt refer to HSE booklet "avoiding danger from underground services"
7. Design Risk Assessment

   A risk assessment relating to potential hazards associated with the works described within this drawing, in so far as they have been designed by EDS Ltd, has been undertaken. Risks identified have been eliminated by design wherever practicable. The status with regard to residual risks is as follows:

   The work is of low complexity with low level of risk; it is considered that there are no significant residual risks that would not be readily foreseeable by a competent contractor, observing good working practices.

   Designer - EDS Drawing revision - A
   Date - 22:10:25

CAUTION !
UNDERGROUND UTILITY SERVICES NOT SHOWN ON DRAWING

DATE.	DRWN.	CHKD.	REV.	NOTES.
22:10:25	JM	TPS	A	PRELIMINARY ISSUE

PROJECT MANAGER:-	JAN CLARK
PROJECT ENGINEER:-	JOSHUA MUNAYRD
DRAWN DATE:-	OCT 2025
SCALE & SHEET SIZE:-	1:1000 @ A1

PRELIMINARY

EDS
Engineering & Development Solutions
- Flood Risk Assessment
- SuDS and Surface Water
- Foul and Sewage Treatment
- Highway Design
- Civil Engineering
- Statutory Approvals

EDS, Unit E4, Threemilestone Industrial Estate, Threemilestone, Truro, Cornwall TR4 9LD (01872) 306311 (Mob) 07973816457
Email: jan@eadsolutions.co.uk
www.eadsolutions.co.uk

CLIENT
CLEAN EARTH ENERGY LTD.

PROJECT
DUBBERS WIND TURBINES

DRAWING TITLE
CONSTRUCTION PHASE LAYOUT

PROJECT No.	DRAWING No.	REV.
J-4142	3001	A

APPENDIX B CALCULATIONS

hr wallingford

Greenfield runoff rate estimation tool

www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

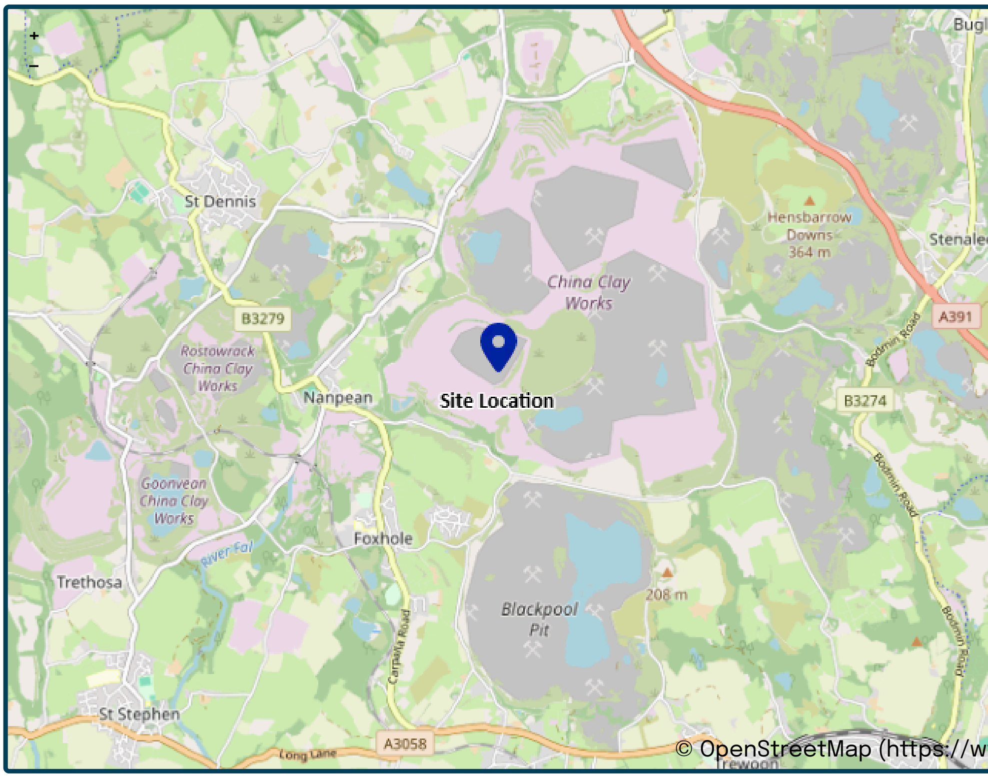
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	19/10/2025
Calculated by	Joshua Munyard
Reference	J-4142
Model version	2.2.1

Location

Site name	Dubbers Windturbine
Site location	Nanpean



Site easting (British National Grid)	197481
Site northing (British National Grid)	55975

Site details

Total site area (ha)	.83	ha

Greenfield runoff

Method

Method	FEH statistical (2025)

FEH statistical (2025)

	My value		Map value
SAAR9120 (mm)	1428 mm		
BFIHOST19scaled	0.441		
QMed-QBar conversion	1.075		1.075
QMed (l/s)	9.6 l/s		
QBar (FEH statistical 2025) (l/s)	10.3 l/s		

Growth curve factors

	My value		Map value
Hydrological region	8		8
1 year growth factor	0.78		
2 year growth factor	0.93		
10 year growth factor	1.49		
30 year growth factor	1.95		
100 year growth factor	2.43		
200 year growth factor	2.78		

Results

Method	FEH statistical (2025)
Flow rate 1 year (l/s)	8.1 l/s
Flow rate 2 year (l/s)	9.6 l/s
Flow rate 10 years (l/s)	15.4 l/s
Flow rate 30 years (l/s)	20.2 l/s
Flow rate 100 years (l/s)	25.1 l/s
Flow rate 200 years (l/s)	28.7 l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

Summary of Results for 100 year Return Period (+50%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	256.433	0.433	10.3	0.0	10.3	217.0	O K
30 min Summer	256.585	0.585	10.3	0.0	10.3	303.9	O K
60 min Summer	256.750	0.750	10.3	0.0	10.3	404.9	O K
120 min Summer	256.847	0.847	10.3	0.0	10.3	467.6	O K
180 min Summer	256.904	0.904	10.3	0.0	10.3	505.8	O K
240 min Summer	256.941	0.941	10.3	0.0	10.3	531.5	O K
360 min Summer	256.985	0.985	10.3	0.0	10.3	561.7	O K
480 min Summer	257.002	1.002	10.3	0.0	10.3	573.8	O K
600 min Summer	257.008	1.008	10.3	0.0	10.3	577.6	O K
720 min Summer	257.008	1.008	10.3	0.0	10.3	578.2	O K
960 min Summer	257.000	1.000	10.3	0.0	10.3	572.0	O K
1440 min Summer	256.963	0.963	10.3	0.0	10.3	546.6	O K
2160 min Summer	256.871	0.871	10.3	0.0	10.3	484.0	O K
2880 min Summer	256.771	0.771	10.3	0.0	10.3	418.4	O K
4320 min Summer	256.548	0.548	10.3	0.0	10.3	282.1	O K
5760 min Summer	256.383	0.383	10.3	0.0	10.3	189.6	O K
7200 min Summer	256.274	0.274	10.3	0.0	10.3	132.2	O K
8640 min Summer	256.203	0.203	10.2	0.0	10.2	96.0	O K
10080 min Summer	256.155	0.155	10.0	0.0	10.0	72.5	O K
15 min Winter	256.482	0.482	10.3	0.0	10.3	244.4	O K
30 min Winter	256.651	0.651	10.3	0.0	10.3	343.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	146.988	0.0	228.5	0.0	22
30 min Summer	103.962	0.0	323.2	0.0	37
60 min Summer	70.616	0.0	439.1	0.0	66
120 min Summer	42.846	0.0	533.1	0.0	126
180 min Summer	32.319	0.0	603.2	0.0	184
240 min Summer	26.569	0.0	661.1	0.0	244
360 min Summer	20.245	0.0	756.0	0.0	362
480 min Summer	16.698	0.0	831.3	0.0	476
600 min Summer	14.357	0.0	893.2	0.0	526
720 min Summer	12.669	0.0	946.1	0.0	594
960 min Summer	10.350	0.0	1030.4	0.0	724
1440 min Summer	7.701	0.0	1150.3	0.0	998
2160 min Summer	5.586	0.0	1252.1	0.0	1412
2880 min Summer	4.425	0.0	1321.4	0.0	1824
4320 min Summer	3.186	0.0	1427.8	0.0	2552
5760 min Summer	2.543	0.0	1519.2	0.0	3232
7200 min Summer	2.171	0.0	1621.3	0.0	3960
8640 min Summer	1.929	0.0	1728.4	0.0	4592
10080 min Summer	1.762	0.0	1843.0	0.0	5336
15 min Winter	146.988	0.0	256.0	0.0	22
30 min Winter	103.962	0.0	362.3	0.0	36

Summary of Results for 100 year Return Period (+50%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
60 min Winter	256.832	0.832	10.3	0.0	10.3	458.2	O K
120 min Winter	256.942	0.942	10.3	0.0	10.3	531.9	O K
180 min Winter	257.009	1.009	10.3	0.0	10.3	578.5	O K
240 min Winter	257.055	1.055	10.3	0.0	10.3	611.2	O K
360 min Winter	257.111	1.111	10.3	0.0	10.3	652.4	O K
480 min Winter	257.139	1.139	10.3	0.0	10.3	673.0	O K
600 min Winter	257.149	1.149	10.3	0.0	10.3	680.5	O K
720 min Winter	257.148	1.148	10.3	0.0	10.3	679.7	O K
960 min Winter	257.134	1.134	10.3	0.0	10.3	669.1	O K
1440 min Winter	257.082	1.082	10.3	0.0	10.3	630.7	O K
2160 min Winter	256.951	0.951	10.3	0.0	10.3	538.4	O K
2880 min Winter	256.806	0.806	10.3	0.0	10.3	440.9	O K
4320 min Winter	256.465	0.465	10.3	0.0	10.3	234.4	O K
5760 min Winter	256.240	0.240	10.2	0.0	10.2	114.6	O K
7200 min Winter	256.125	0.125	9.8	0.0	9.8	57.9	O K
8640 min Winter	256.068	0.068	9.2	0.0	9.2	31.3	O K
10080 min Winter	256.051	0.051	8.6	0.0	8.6	23.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
60 min Winter	70.616	0.0	492.0	0.0	66
120 min Winter	42.846	0.0	596.9	0.0	122
180 min Winter	32.319	0.0	675.7	0.0	180
240 min Winter	26.569	0.0	740.4	0.0	238
360 min Winter	20.245	0.0	846.8	0.0	352
480 min Winter	16.698	0.0	931.1	0.0	464
600 min Winter	14.357	0.0	1000.8	0.0	570
720 min Winter	12.669	0.0	1059.7	0.0	670
960 min Winter	10.350	0.0	1154.7	0.0	762
1440 min Winter	7.701	0.0	1288.4	0.0	1072
2160 min Winter	5.586	0.0	1402.1	0.0	1536
2880 min Winter	4.425	0.0	1481.2	0.0	1988
4320 min Winter	3.186	0.0	1599.0	0.0	2684
5760 min Winter	2.543	0.0	1701.6	0.0	3296
7200 min Winter	2.171	0.0	1816.0	0.0	3896
8640 min Winter	1.929	0.0	1936.1	0.0	4504
10080 min Winter	1.762	0.0	2064.0	0.0	5144

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 197412 56135 SW 97412 56135
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+50

Time Area Diagram

Total Area (ha) 0.830

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.415	4	8	0.415

Model Details

Storage is Online Cover Level (m) 257.500

Tank or Pond Structure

Invert Level (m) 256.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	450.0	1.200	761.4	1.500	852.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0143-1030-1300-1030
Design Head (m)	1.300
Design Flow (l/s)	10.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	143
Invert Level (m)	255.900
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	10.3
Flush-Flo™	0.387	10.3
Kick-Flo®	0.833	8.3
Mean Flow over Head Range	-	8.9

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	5.2	1.200	9.9	3.000	15.3	7.000	22.9
0.200	9.6	1.400	10.6	3.500	16.4	7.500	23.7
0.300	10.2	1.600	11.3	4.000	17.5	8.000	24.4
0.400	10.3	1.800	12.0	4.500	18.5	8.500	25.2
0.500	10.2	2.000	12.6	5.000	19.5	9.000	25.9
0.600	9.9	2.200	13.2	5.500	20.4	9.500	26.5
0.800	8.8	2.400	13.7	6.000	21.3		
1.000	9.1	2.600	14.3	6.500	22.1		

Pipe Overflow Control

Diameter (m)	0.150	Roughness k (mm)	0.600
Slope (1:X)	10.0	Entry Loss Coefficient	0.500
Length (m)	10.000	Coefficient of Contraction	0.600

Pipe Overflow Control

Upstream Invert Level (m) 257.200

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