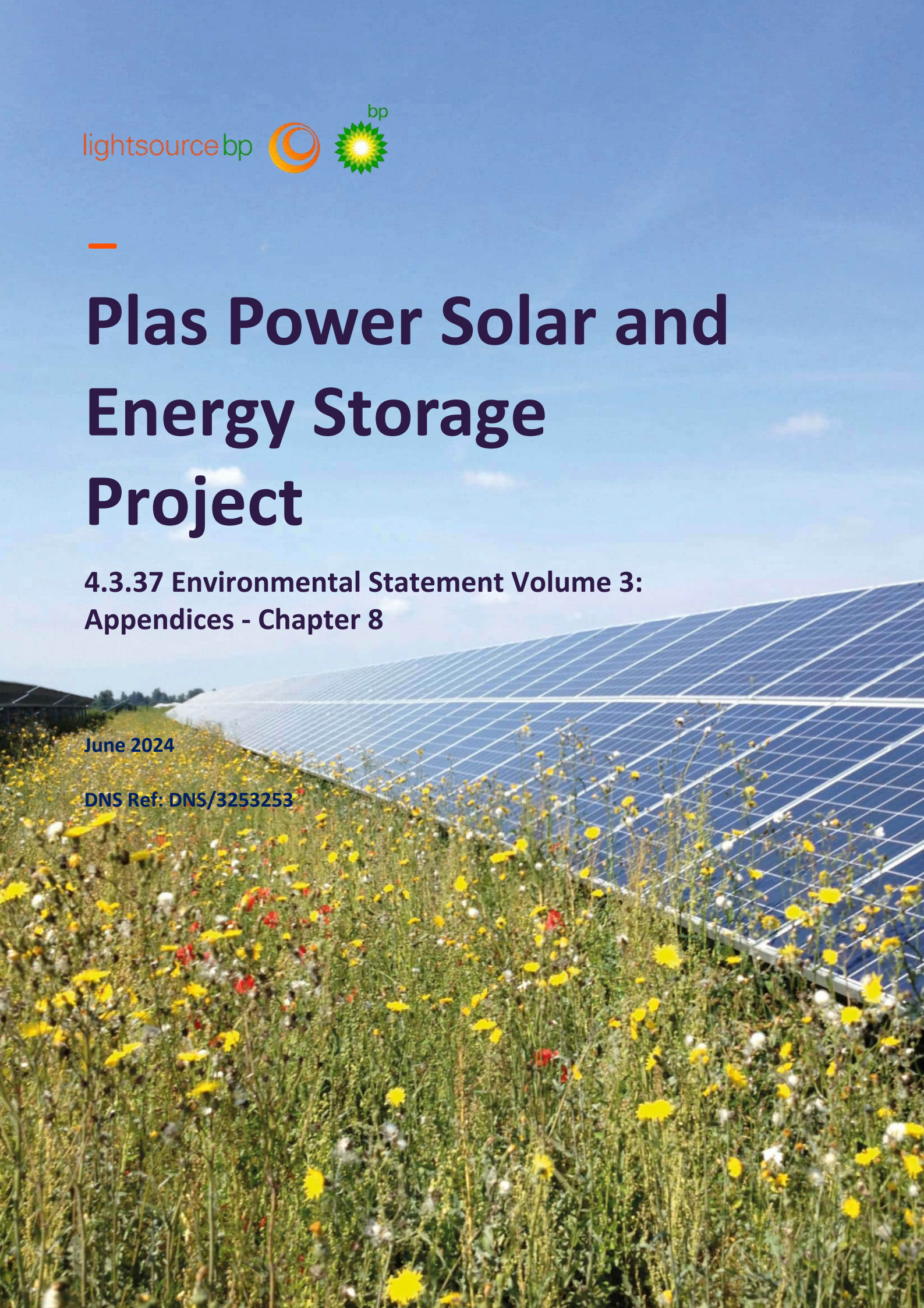


Plas Power Solar and Energy Storage Project

4.3.37 Environmental Statement Volume 3: Appendices - Chapter 8

June 2024

DNS Ref: DNS/3253253

MAKING COMPLEX EASY

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Chapter 8: Hydrology and Hydrogeology
Appendices

Appendix 8.1: PLAS POWER SOLAR AND BATTERY PROJECT

Flood Consequence Assessment and Drainage Assessment



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Quality Management

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1 SCOPE OF WORK

1.1 Background

1.1.1 At the request of Lightsource bp, RPS Consulting Services Ltd (RPS) has prepared a site-specific Flood Consequence Assessment (FCA) for the development of a solar and battery project at land at Plas Power Estate, Ruthin Road, Wrexham LL11 3BS. The DNS reference for the site is DNS/3253253. The key objectives of the FCA are:

- To assess the flood risk to the Proposed Development and to demonstrate the feasibility of appropriately designing the development such that any residual flood risk to the development would be acceptable;
- To assess the potential impact of the Proposed Development on flood risk elsewhere and to demonstrate the feasibility of appropriately designing the development such that the development would not increase surface water on Site or elsewhere; and
- To assess potential drainage strategies to minimise flood risk and surface water flooding due to the implementation of the proposed development.

1.2 Project Scope

1.2.1 The report has been produced in accordance with the guidance detailed in Planning Policy Wales and Technical Advice Note 15 (TAN15): Development and Flood Risk. Reference has also been made to local flood risk documents and provides an outline of the potential flood risk and hydrological constraints to the site.

1.3 Limitations

1.3.1 The report is based on publicly available hydrological and flood risk data extracted from the National Resources Wales website (DataMap Wales). The report, therefore, provides a desktop assessment.

2 SOURCES OF INFORMATION

2.1 Introduction

2.1.1 Information sources consulted during preparation of this report are listed in Table 2-1 below.

Table 2-1. Reports consulted during preparation of the document

Reports Consulted		
Source	**Data**	**Information consulted/provided**
Wrexham County Borough Council	Unitary Development Plan (2023)	The document outlines local planning policies.
Wrexham County Borough Council	Preliminary Flood Risk Assessment (2011)	The document identifies areas where there is significant flood risk from local sources, namely ordinary watercourses, surface water runoff and groundwater.

2.2 Legislation and Guidance

Planning Policy Wales Edition 12, 2021

2.2.1 Planning Policy Wales Edition 12 sets out the land use planning policies of the Welsh Government. Chapter 6 – Distinctive and Natural Places outlines the Welsh Government's objectives in terms of addressing water and flood risk.

2.2.2 Section 6.6 of Planning Policy Wales addresses water and floor risk. The relevant guidance is summarized below:

- The planning system should:
  - protect and improve water resources and quality by promoting and encouraging increased efficiency and demand management of water as part of new developments;
  - ensure that the infrastructure networks, including nature based solutions on which communities and businesses depend is adequate to accommodate proposed development, and takes into consideration the impacts of climate change, so as to minimise risk to human health and the environment and prevent pollution at source;
  - ensure sustainable drainage systems are an integral part of design approaches for new development; and
  - ensure the protection of the quantity and quality of surface and ground water supplies is taken into account as part of development proposals.
- Water resources and quality must be taken into account from an early stage in the process of identifying land for development and redevelopment.
- Ensuring the implementation of nature based solutions through green infrastructure provision is a key preference and protecting river corridors should be maximised. The identification of managed wetland and riparian buffer zones should be a key output of assessments to improve water quality, by reducing pollution and securing a net benefit for biodiversity and improving the attributes of ecosystem resilience.
- New development should be located and implemented with sustainable provision of water services in mind, using design approaches and techniques which improve water efficiency135 and minimise adverse impacts on water resources, including the ecology of rivers, wetlands and groundwater and thereby contributing towards ecological resilience.

- Planning authorities should secure better management of drainage and surface water so as to tackle these issues by:
    - ensuring sustainable drainage systems are incorporated into development enabling surface water to be managed close to or at source; and
    - ensuring connection to the sewer in sewered areas and by minimising the proliferation of private sewage systems.
- New developments of more than one dwelling or where the area covered by construction work equals or exceeds 100 square metres also require approval from the SuDS Approval Body (SAB) before construction can commence. This will ensure that SuDS infrastructure is properly maintained and functions effectively for its design life.
- The provision of SuDS must be considered as an integral part of the design of new development and considered at the earliest possible stage when formulating proposals for new development.
- Planning authorities should adopt a precautionary approach of positive avoidance of development in areas of flooding from the sea or from rivers. Surface water flooding will affect choice of location and the layout and design of schemes, and these factors should be considered at an early stage in formulating development proposals.
- Development should reduce, and must not increase, flood risk arising from river and/or coastal flooding on and off the development site itself. The priority should be to protect the undeveloped or unobstructed floodplain from development and to prevent the cumulative effects of incremental development.
- In areas of flood plain currently unobstructed, where water flows in times of flood, built development should be wholly exceptional and limited to essential transport and utilities infrastructure.
- Development should not cause additional run-off, which can be achieved by controlling surface water as near to the source as possible by the use of SuDS.
- The ability of emergency services to respond to flood events should be taken into account when considering if a development in a flood risk area is appropriate. This may involve consultation with emergency planners, local resilience forums and other professional partners such as fire rescue, police and ambulance services.

2.2.3 Planning Policy Wales is supplemented by a series of Technical Advice Notes (TAN). TAN15 provides technical guidance on development and flood risk.

Technical Advice Note (TAN) 15: Development and Flood Risk

2.2.4 TAN 15 provides technical guidance to supplement the policy set out within Planning Policy Wales in relation to development and flooding. The guidance relates to sustainability principles and provides a framework to allow risks arising from river flooding, coastal flooding and additional run off from developments to be assessed.

2.2.5 In relation to flood risk, TAN 15 indicates that the Assembly has a duty to ensure that development is sustainable and does not create problems for future generations. Managing flooding has an important role to ensure sustainable development by: guiding developments to locations with little or no risk from river, tidal or coastal flooding, managing consequences of flooding where developments can be justified and making provision for climate change.

2.2.6 TAN 15 confirms that each planning authority in Wales must prepare a Development Plan for its area. The development plans provide locational guidance for development, detailed site-specific policies, and identification of proposals for development. Catchment Flood Management Plans aim to take a holistic approach to flood management at a catchment scale and can provide guidance on

managing risk to future developments. The information provided in local development plans and catchment flood management plans will aid with the application of the Justification Test.

Requirements of TAN 15

2.2.7 A Flood Consequence Assessment, to support a development application, should be proportionate to the risk and appropriate to the scale, nature, and location of the development. The following will need to be considered;

- The consequences of flooding on the development, the consequences of the development on flood risk elsewhere and if appropriate mitigation measures can be incorporated into the design.
- Mechanisms of flooding, including sources of floodwater, how floodwater enters and flows across a site, height, and speed of floodwaters.
- Uncertainties in estimating flood events including use of historical records and forecasting.
- Security of Proposed Developments over their lifetime and ensuring those using the development have an awareness of the potential risks from flooding.
- Description of consequences under a range of extreme events including mechanisms, sources, depths, speed, rate of rise, overland flood routes, velocity, access and egress, impacts on natural heritage, impact on flood risk in surrounding areas.
- Structural adequacy of defences to contain flows and withstand overtopping and if required the suitability of implementing a buffer zone adjacent to defences.
- Measures required to ensure flooding is managed to acceptable levels and ensure that the impact upon flood risk elsewhere in the flood plain is managed.

TAN15 updates

2.2.8 Updates to TAN15 are due to come in to force in 2024. These include updated modelling to incorporate the risk of climate change in Fluvial/Tidal Flood Zones. As well as the addition of Surface Water and Small Watercourses Flood Zones which also incorporate climate change.

2.2.9 This update takes precedent over current guidance as it provides more recent modelling, and the guidance will be in force following completion of the development. Therefore, although current guidance is referenced the updated guidance has been followed within this report.

2.3 Local Planning Policy

Wrexham Unitary Development Plan

2.3.1 The adopted Wrexham County Borough Council Unitary Development Plan (UDP) covers 2013 – 2028 and was adopted in December 2023. The UDP is a long-term land use and development strategy, focused on achieving sustainable development which:

- guides development for housing, employment, retail and other uses
- set out policies that will be used to decide planning applications
- safeguard areas of land requiring protection or enhancement

In addition, the County Council of Wrexham have prepared the following document relevant information from which was used in this assessment:

Wrexham County Borough Council Preliminary Flood Risk Assessment

2.3.2 Preliminary Flood Risk Assessment (PFRA) is a high-level screening exercise to identify areas where there is significant flood risk from local sources, namely ordinary watercourses, surface water runoff and groundwater. It does not directly consider flooding from main rivers or from sewers. PFRAs have been produced by Lead Local Flood Authorities (LLFAs) to fulfil statutory requirements in the Flood Risk Regulations 2009. In this case the LLFA is the Wrexham County Borough Council and the PFRA1 was published in 2011.

2.3.3 The report is not currently available to review online.

Wrexham County Borough Council Local Flood Risk Management Strategy

2.3.4 The Local Flood Risk Management Strategy (LFRMS) report published in 2013 sets out the principles, objectives and measures for the management of local flood risk by Wrexham County Borough Council as the LLFA (where “local flood risk” is defined as “surface water runoff, ground water and ordinary watercourses and included any lake, pond or other body of water that feeds from an ordinary watercourse”).

2.4 Climate Change

2.4.1 TAN15 states that when considering new development proposals, it is necessary to take account of the potential impact of climate change over the lifetime of development. Solar panel development is assumed to have a lifetime of 40 years. To ensure future development can provide a safe and secure living and /or working environment throughout its lifetime, national planning policy requires proposals in areas of high flood risk to be accompanied by an assessment of flooding consequences to and from the development, taking into account the impacts of climate change.

2.4.2 In line with TAN15, the climate change allowances have been informed by latest available information on climate change projections and different scenarios of carbon dioxide (CO2) emissions to the atmosphere. Allowances are provided for different epochs (periods) of time over the next century. This guidance will be reviewed when more up-to-date climate change research is available.

2.4.3 Both the central and upper end allowances should be assessed to understand the range of impact. As a minimum, proposals should be assessed against the central allowance to inform design levels. It is recommended that the 2080s changes are used when considering any time beyond 2115.

2.4.4 Table 2-2 presents the peak river flow allowances for the Dee River Basin catchment. Table 2-3 presents the expected change to Extreme Rainfall Intensity. The climate change allowances are based on UKCP09 and emerging UKCP18 research data.

Table 2-2. Peak River Flow Allowances by River Basin District (use 1961 to 1990 baseline)

River Basin District	Allowance Category	Total potential change anticipated for ‘2020s’ 2015-2039)	Total potential change anticipated for ‘2050s’ (2040-2069)	Total potential change anticipated for the ‘2080s’ (2070-2115)
Dee	Upper Estimate	20%	30%	45%
	Central Estimate	10%	15%	20%

Table 2-3. Change to Extreme Rainfall Intensity Compared to a 1961-90 Baseline

Change to Extreme Rainfall Intensity			
Applies across all of Wales	Total potential change anticipated for '2020s' 2015- 2039)	Total potential change anticipated for '2050s' (2040- 2069)	Total potential change anticipated for the '2080s' (2070-2115)
Upper Estimate	10%	20%	40%
Central Estimate	5%	10%	20%

2.4.5 The Guidance recommends that the central estimate, or change factor, for the 2080s for the relevant river basin district and peak rainfall intensity should be used to assess the potential impact of climate change as part of a flood consequence assessment. As such the 20% allowance should be used.

2.4.6 The allowances are consistent with the A1B (medium) emissions scenario derived from latest research projects and converted into regionalised data of climate change on flood flows for the 2020s, 2050s and 2080s time-horizon, and for the B1 (low) and A1F1 (high) emissions scenarios for the 2080s time-horizon.

2.4.7 Runoff and attenuation calculation for any development design would have to take into account the above change in climate change policy.

3 SITE SETTING

3.1 Site Location

3.1.1 The Site is located on land at Plas Power Estate, Ruthin Road, Wrexham with the nearest postcode LL11 3BS. The Site is centred on grid reference is SJ 305 500 and encompasses an area of approximately 136ha. The site is split across two parcels of land north and south of Ruthin Road, connected by a proposed cable route corridor. The land parcels are connected to Legacy power station via a cable route corridor within the southern extent of the site. Figure 1 below demonstrates approximate Site boundaries.

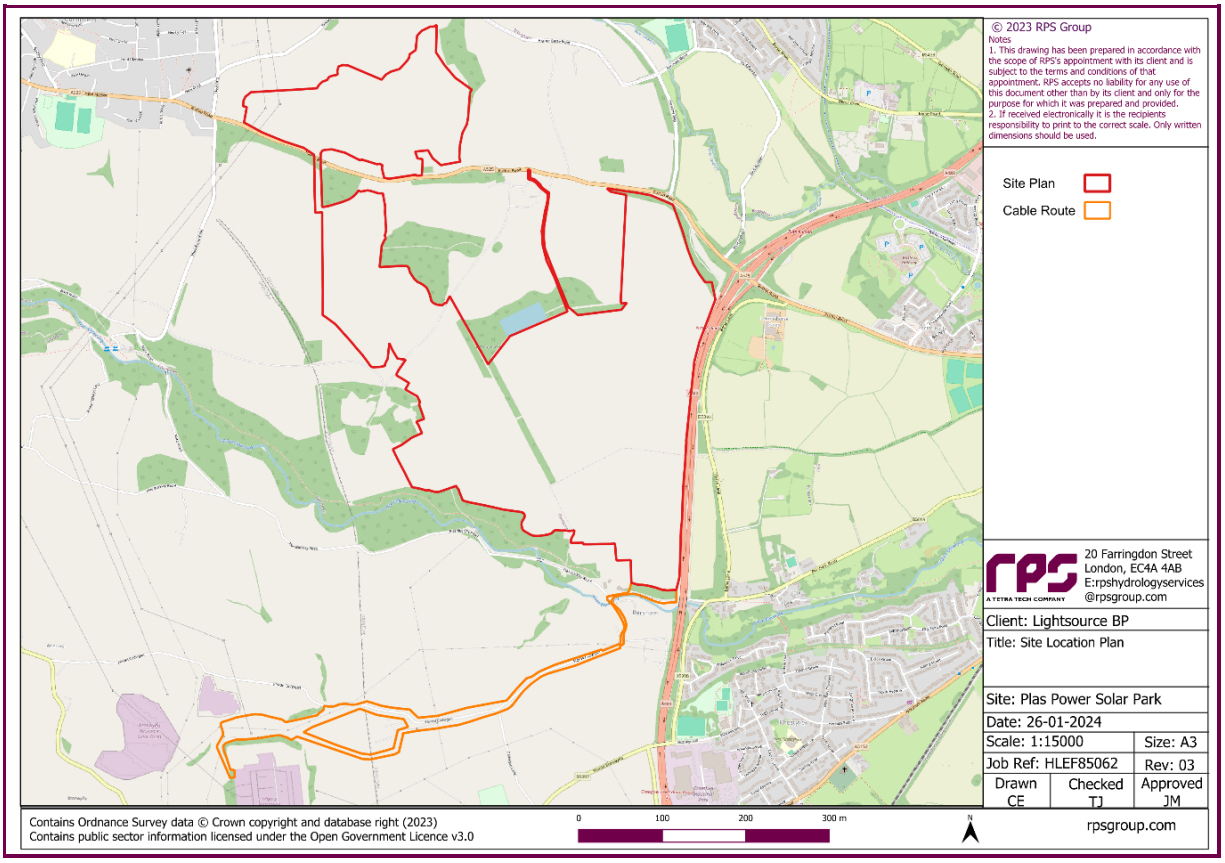


Figure 1. Site Location

3.2 Existing Land Use

3.2.1 The Site occupies approximately 136 ha of pastural and arable agricultural land with field boundaries delineated by hedgerows and trees. Ruthin Road (A525) and Plas Buckley Road bisect the site area from east to west, and a farm track bisects the north of the southern site plan, as well as a footpath in the south.

3.3 Surrounding Land Uses

3.3.1 The south the site is bordered by agricultural land and woodland, with residential and agricultural buildings located in close proximity. Plas Buckley Road is located 35m south with the River Clywedog is located approximately 45 m south. The west of the site is bordered by further agricultural land, with areas of woodland and agricultural and residential buildings located adjacent. The north of the site is bordered by Tanllan Lane, as well as agricultural land. The east of the site is bordered by further agricultural land, woodland, and the A483 road. Wrexham City Centre is located

in the wider area approximately 2.5km to the east. The centre of the site is bisected by agricultural land, woodland, residential properties and farmyards, and Ruthin Road (A525).

3.3.2 There are no designated sensitive areas (e.g. Special Area of Conservation (SAC), Special Protection Area (SPA) or Site of Special Scientific Interest (SSSI)) on site or within close proximity to the site.

3.4 Topography

3.4.1 From contour lines presented within the Proposed Development Layout, presented within **Appendix A**, site levels fall from a high point of 180mAOD (meter above ordnance datum) within the north-western extent of the northern parcel of the site to approximately 102mAOD within the south-eastern extent of the southern land parcel.

3.4.2 Field drains can be identified from the topography in the east of the southern parcel, there are two drains identified as being 0.3-0.5m below the surrounding topography.

4 PROPOSED DEVELOPMENT

4.1.1 The Proposed Development will consist of the construction of solar panels mounted on metal frames, new access tracks, underground cabling, perimeter fencing with CCTV cameras, switchgear substations, inverters, transformer stations, auxiliary transformers, permanent storage containers, monitoring houses, Battery Energy Storage at the Site (BESS) and all ancillary grid infrastructure and associated works. It will also include landscaping and ecological enhancement areas.

4.1.2 The main components of the Proposed Development are:

- Solar arrays comprising solar panels and frames;
- Inverters;
- Transformers;
- Cabling;
- Substations;
- BESS;
- Internal access tracks; and
- Landscaping and ecological enhancement areas.

4.1.3 Proposed development is classified as 'Less Vulnerable' within TAN15.

4.1.4 The solar farm and battery site will connect to the National Grid via an underground cable to the Legacy Substation located approximately 600m to the south-west of the site. Five cable routes are currently being assessed as part of this connection.

4.1.5 The Proposed Development is temporary and fully reversible; the land can be restored to its present state at the end of the facilities planned life.

4.1.6 The potential to provide surface water attenuation, including the use of Sustainable Drainage Systems (SuDS), has been considered as part of the preliminary design process (see Section 10 – Surface Water Management).

4.2 Solar Panels

4.2.1 Solar panels, also known as photovoltaics (PV), are made up of cells, which convert the light energy from daylight into electrical energy.

4.2.2 The solar will be constructed across the northern and southern parcels of land. There is anticipated to be 2-2.5m between each row of panels, this will help to avoid inter-panel shading.

4.2.3 The solar panels will be attached to metal frames or mounting structures which together form PV tables (or modules). The PV tables will be typically fixed to pile driven galvanised steel posts. When the site is decommissioned, the frame piles are simply pulled out from the ground causing minimal ground disturbance.

4.2.4 The frames will allow the panels to be positioned at an angle of between 12-18 degrees from the horizontal axis and orientated to the south, typically the height of a panel will be 3.055m to the top of the panel frame on level ground, including 1m of ground clearance to enable maintenance access and continued sheep grazing below the PV modules. However, subject to the topography, the height of the panel could be up to 3.20m high. The plans for a typical solar panel is included in **Appendix B.** The solar panels will be arranged over module tables; either in columns of 30 x rows of 2, or 15 columns x 2 rows.

4.2.5 The solar panels will be set back from the site boundaries to allow for landscaping and screen planting, perimeter security fencing, CCTV coverage, access tracks and maintenance access.

4.3 Cable Route

4.3.1 All of the cabling within the northern and southern areas of the site will be laid underground via surface dug trenches of approximately 1m deep and 50cm wide and backfilled. These will utilise existing access tracks and road options wherever possible, particularly where sensitive habitats or archaeology are potentially present.

4.3.2 A cable route between the northern and southern parcels will be installed using Horizontal Directional Drilling (HDD) under the road and trees into the site and via an existing Public Right of Way (PRoW).

4.3.3 The 33kV cable route to connect to the existing Legacy Substation will pass to the east of Bersham Ironworks Museum, under the River Clywedog and Clywedog Trail via HDD, and follow the unnamed road south-west for approximately 800m. From here it will either pass to the north of Cadwgyn hall or to the south where it crosses Offas Dyke, before connecting to Legacy Substation from the west side.

4.4 Ancillary Features

Inverters, Transformers and Switchgear Substations

4.4.1 Lightsource bp are currently considering two inverter options:

- String inverters; or
- Central inverters.

4.4.2 The inverters are required to convert the Direct Current (DC) electricity generated by the panels, to Alternating Current (AC) which is compatible with the wider UK grid network. From the inverters, the electricity flows to a transformer which ‘steps-up’ the voltage of the electricity from low voltage (LV) to medium voltage (MV) before it reaches the switchgear substations. The switchgear substations include a ‘switch’ mechanism to shut parts or all of the solar farm off from the wider network in the event of a fault (similar to a household fuse box).

4.4.3 String inverters would be mounted onto support frames whilst central inverters would be situated in pairs at regular intervals throughout the site. Central inverters are larger and comprise containerised units, as shown in grey on the site layout and will measure up to approximately 8.2m long (L), 2.3m wide (W) and 2.8m high (H) (including the base). 26no inverters are required. For the purpose of the drainage design, central inverters are assumed to be included representing a worst-case both in terms of scale.

4.4.4 The proposed transformers will be up to approximately 5.5m (L), 4.5m (W) and 3.2m (H). These are an ‘open air’ design, surrounded by a fence and accompanied by a switchgear substation. The switchgear substations will be up to 4.2m (L), 2.6m (W) and 3.15m (H) (including the base). 26no. Transformers and 13no. Switchgear Substations are proposed.

4.4.5 The inverters, transformers and switchgear substations will be sited on a hardcore base.

Auxiliary Transformer

4.4.6 There will be one auxiliary transformer located within the site adjacent to the customer substation in the south-west of the site. This will be up to approximately 3.8m (L) x 3.8m (W) 3.2m (H). The auxiliary transformer will provide low voltage electricity supply to ensure the safe and secure operation of the site.

Substations

4.4.7 All electricity from across the solar PV arrays will collect at a substation (referred to as the 'PV Intake Substation') which will be installed to the south-west of the site. The PV Intake Substation will be up to approximately 10.5m (L) x 2.5m (W) 3.1m (H) (including the base).

4.4.8 A further BESS Intake Substation will be located in the BESS compound as described below. Both the PV Intake and BESS Substations connect into the Customer Substation which will be owned, operated and maintained by the operator. From here, a high voltage (HV) cable buried underground, will connect the solar farm to the existing grid network. The customer substation will be up to approximately 10.3m (L) x 5.0m (W) 3.9m (H) (including the base).

4.4.9 A GRP cabinet supplies low-voltage power to the Battery Storage systems, facilitating ventilation and refrigeration for the battery units. Its GRP structure offers a more compact footprint compared to the brick building option and will be 3.00m (L) x 3.00m (W) x 2.55m (H).

Spares Container

4.4.10 It is proposed that one permanent spares container will be located within the site to store miscellaneous spare parts. This unit will measure approximately 12.4m (L) x 2.6m (W) x 2.9m (H).

Monitoring House

4.4.11 A monitoring house is required to enable remote monitoring of the solar PV site. This building is typically up to approximately 3.9m (L) x 3.2m (W) and 3.3m (H) (including the base). This building will provide daily information/data in relation to the operation of the solar farm. During a solar farm's operation, data communication is vital to facilitate information flow from equipment such as inverters to a central control centre and alert Lightsource bp to any potential operational issues with the solar farm and or battery storage compound. In addition to this an up to approximately 5.05m (above ground level) weather station attached to the outside of the building is proposed to monitor wind speed, direction, and temperature.

4.5 BESS Components

4.5.1 The BESS allows for surplus energy generated at times of high production to be stored and dispatched to the grid at times when the energy is needed. The BESS therefore contributes to balancing the intermittent energy production and maximises the site's efficiency to allow a greater output of clean energy.

4.5.2 The BESS will be located to the south of the site, close to the infrastructure associated with the solar farm, and away from residential properties and sensitive viewpoints.

4.5.3 The BESS will include 14no. BESS enclosures, 14no. BICs, 7no. twin MV Skid, a BESS backup generator, a BESS spares container, a BESS intake substation and a BESS Monitoring House.

The BESS Components are summarised in Table 4-1 below.

Table 4-1. BESS Components

BESS Component	Dimensions
14 x 4 BESS Enclosures	16.62m (L) x 3.88m (W) x 3.0m (H) (each)
14 x BIC (Battery Interface Cabinet)	2.2m (L) x 1.1m (w) x 2.3m (H) (each)
7 x Twin MV Skid	10.8 (L) x 6.8m (W) x 3.96m (H)

BESS Component	Dimensions
1 x BESS Backup Generator	6.3m (L) x 2.64m (W) x 2.89m (H)
1 x BESS Spares Container	6.3m (L) x 2.64m (W) x 2.9m (H)
1x BESS Intake Substation	15.70m (L) x 3.00m (W) x 3.60m (H)
1x BESS Monitoring House	3.86m (L) x 3.2m (W) x 3.3m (H)

4.6 Access

4.6.1 The main site access will be via the A525. The northern land parcel will connect to this road from the south with the southern land parcel connecting to this road to the north. Three access points to the site are situated on the A525, two for the Southern parcel and one for the Northern parcel.

4.6.2 Existing farm tracks will be used for internal access within the site wherever possible. New access tracks, where required, will be formed, normally using a layer of permeable crushed stone. Geosynthetic reinforcement or soil stabilisation may be used to reduce the depth of track construction. The surface will be a compacted granular material (crushed rock) up to an approximate thickness of 0.3m, dependent on the ground conditions. Width will increase at bends and at the entrance point. The tracks will measure between 3.5m and 4.5m wide.

5 HYDROLOGICAL SETTING

5.1 Nearby Watercourses

5.1.1 The watercourses in proximity to the site are shown in **Figure 2**.

5.1.2 The River Gwenfro, a main river, is located approximately 350m northeast of the site. A tributary of this river is located 180m northeast of the site which joins the River Gwenfro approximately 500m east. The River Gwenfro flows through Wrexham City Centre, before joining the River Clywedog east of the City Centre and 3.8km east of the site.

5.1.3 The River Clywedog is also a main river located within the southern extent of the southern land parcel and bisects the northern extent of the cable route corridor.

5.1.4 An unnamed watercourse flows eastwards approximately 100m to the north of the cable route corridor route. The watercourse discharges to the River Clywedog approximately 75m to the west of the cable route corridor.

5.1.5 There are three drains located in the southern land parcel, located along the boundaries of the agricultural fields. The southern drain appears to drain into the River Clywedog. Two ponds are also present; one within the centre of the site (however not located within the site boundary) and a second located beyond the south-western boundary of the southern land parcel. Drains and ponds appear to be associated with agricultural land use.

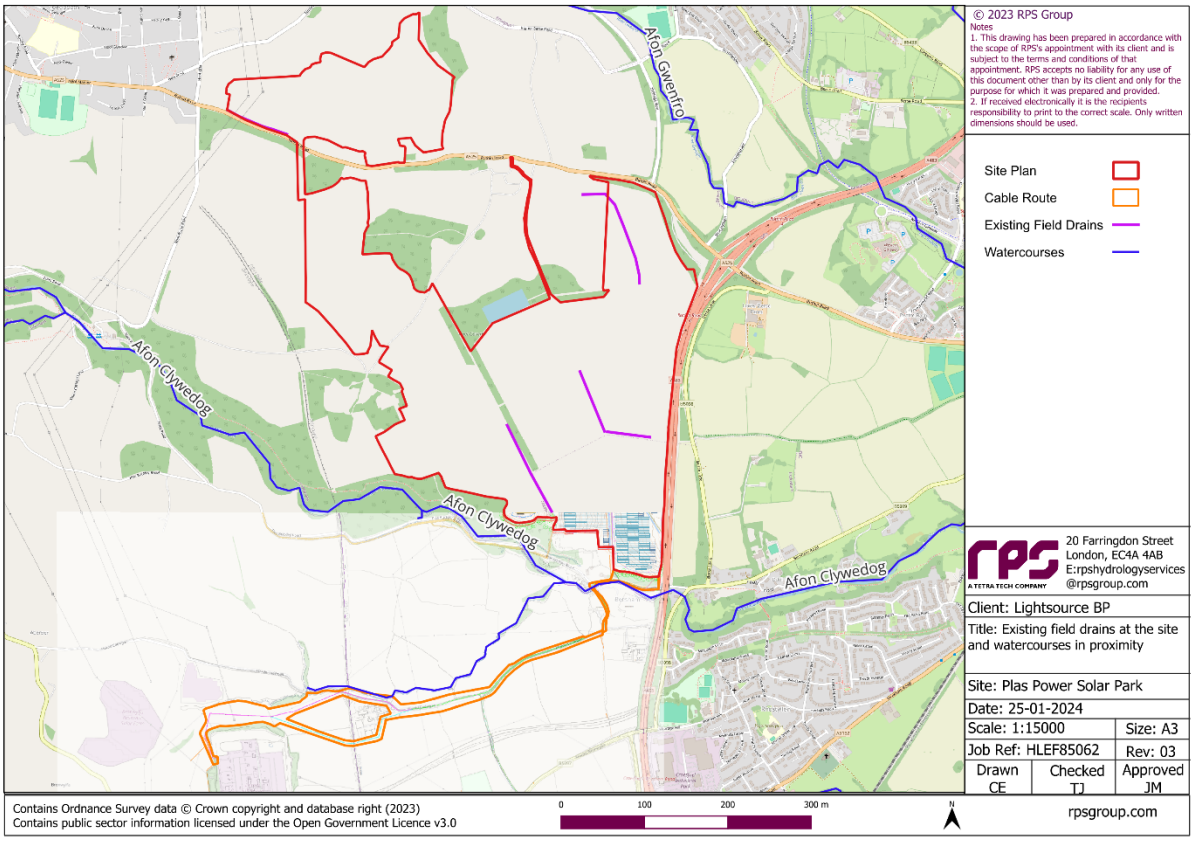


Figure 2. Location of watercourses at and in proximity of the site

5.2 Fluvial Flood Risk Classification

Development Advice Mapping

5.2.1 The Welsh Assembly Government produces Development Advice Maps (DAM) to accompany TAN 15. These maps show the degree of flood risk which is to be applied to the Site for the planning process and thus establish the suitability of the Site for development. These maps are based upon the Natural Resource Wales flood maps and similarly they can be modified through the presentation of data (i.e. hydraulic modelling) to illustrate that a Site is within a different flood zone. The development advice zones are listed below, alongside their attributed planning actions:

5.2.2 The development advice zones are listed below, alongside their attributed planning actions:

- Zone A: Areas considered to be at little or no risk of fluvial or tidal/coastal flooding. Flood risk within this zone does not need to be considered further.
- Zone B: Areas known to have been flooded in the past evidenced by sedimentary deposits. Areas within this zone are further checked against the 0.1% flood level.
- Zone C1: Based on Environment Agency 0.1% flood outline and are areas of the floodplain developed served by significant flood defence infrastructure.
- Zone C2: Based on the Environment Agency 0.1% flood outline and areas of the floodplain without significant flood defence infrastructure.

The Development Advice Map for the site is presented for the site in **Figure 3**.

5.2.3 The northern and southern land parcels are situated wholly within Zone A. There are areas of Zone C1 and C2 located in close proximity to the northern and southern land parcels. These areas are near to the southern boundary owing to the River Clywedog and in proximity to the north eastern boundary owing to the River Gwenfro located in the wider area to the north.

5.2.4 The associated cable route corridor is predominantly located within Zone A. There are limited areas of Zone C2 and Zone B within the northern and central extent of the cable route corridor, associated with fluvial flooding from the River Clywedog and its unnamed tributary.

5.2.5 The associated access roads are situated within Zone A.

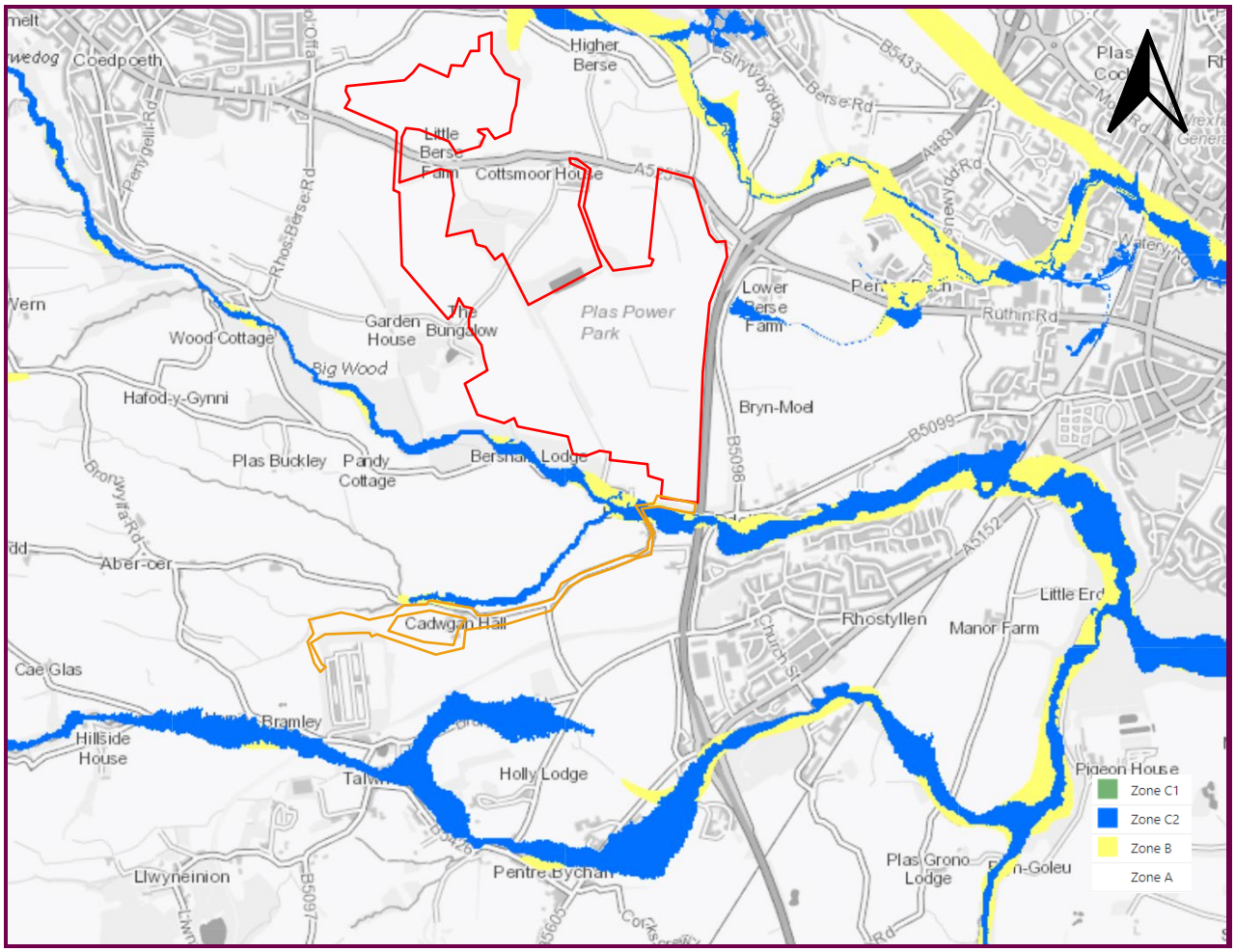


Figure 3. NRW Development Advice Map

TAN15 Updates

5.2.6 RPS notes a revised TAN15 is due to be implemented in 2024. This will be supported by the new Flood Map for Planning, which includes climate change information to show how this will affect flood risk extents over the next century. It shows the potential extent of flooding assuming no defences are in place.

5.2.7 The Flood Map for Planning has no official status for planning purposes until the revised TAN 15 is implemented. However, given the completion of the development is likely to extend beyond this date and it provides more up to date assessment of the risk it takes precedent over current guidance. As such mitigation has been referenced in line with the findings of this data.

5.2.8 The climate change data is taken from the 'central estimate' epochs and as such is considered an appropriate assessment of future risk for 'essential infrastructure' developments in line with TAN15 guidance.

5.2.9 The Flood Zones are divided into the following categories:

- Flood Zone 1 (Rivers) are areas with a less than 0.1% (1 in 1000) chance of flooding from rivers each year, including the effects of climate change.
- Flood Zone 2 (Rivers) are areas with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from rivers each year, including the effects of climate change.
- Flood Zone 3 (Rivers) are areas with more than 1% (1 in 100) chance of flooding from rivers each year, including the effects of climate change.

5.2.10 Flood Zones are presented within **Figure 4** The northern and southern land parcels are situated wholly within Zone 1. There are areas of Flood Zone 2 and 3 located in close proximity to the northern and southern land parcels. These areas are near to the southern boundary owing to the River Clywedog and in proximity to the north eastern boundary owing to the River Gwenfro located in the wider area to the north.

5.2.11 The associated cable route corridor is predominantly located within Flood Zone 1 with limited areas of Flood Zone 3 within the northern and central extent of the cable route corridor, associated with fluvial flooding from the River Clywedog and its unknown tributary.

5.2.12 The associated access roads are situated within Flood Zone 1.

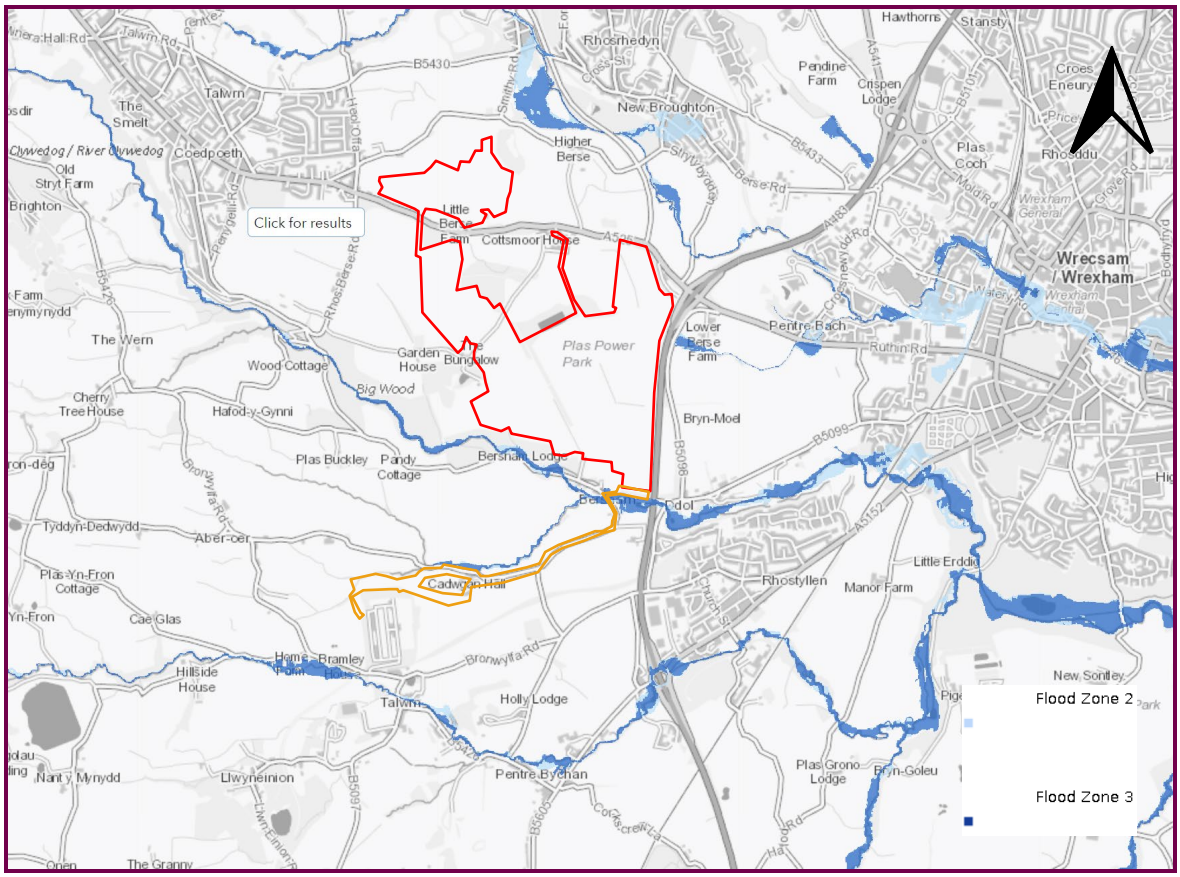


Figure 4. NRW Flood Map for Planning (Rivers and Sea)

5.2.13 NRW National Flood Maps - Flood Risk from Rivers mapping is further used to assess flood risk to the Site with risk of flooding divided into the following categories:

- High risk: The area has a chance of flooding of greater than 1 in 30 (3.3%) each year.
- Medium risk: The area has a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%) each year.
- Low risk: The area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%) each year.
- Very low risk: The area has a chance of flooding of less than 1 in 1000 (0.1%) each year.

5.2.14 The current NRW Flood Risk from Rivers map, presented within in **Figure 5**. The northern and southern land parcels are located outside the mapped extent of risk of flooding from this source. The associated cable route corridor has a 'low - high' risk of flooding from this source, associated with fluvial flooding from the River Clywedog and its unnamed tributary.

5.2.15 Flood depth information relating to the low risk (worst-case) scenario shows flood depths of less than 0.15m within the central extent of the cable route corridor inundated by flooding associated with the tributary of the River Clywedog. The northern extent of the cable route corridor inundated by flooding associated with the River Clywedog experiences out of bank flooding of up to 0.90m.

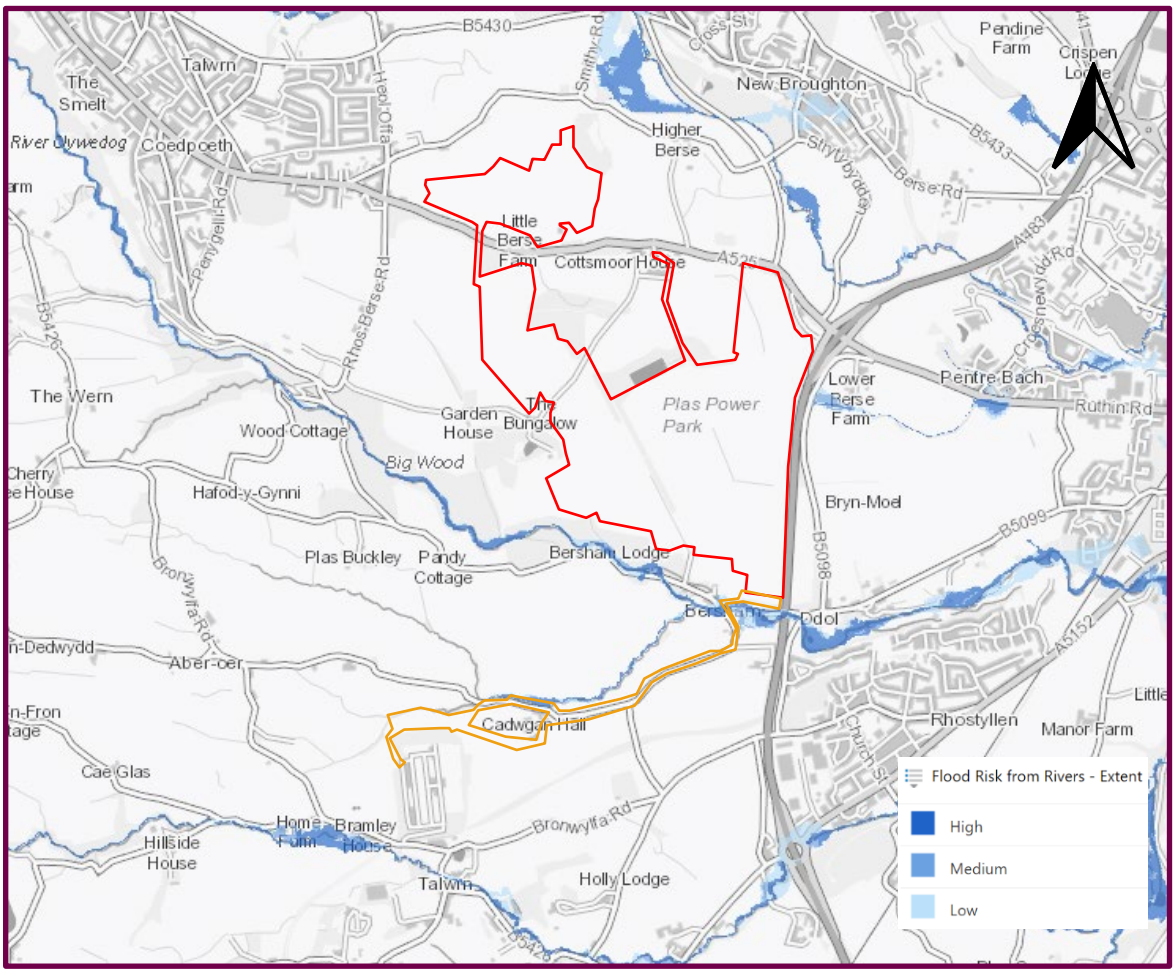


Figure 5. Natural Resources Wales Flood Risk from Rivers Map

Flood Warnings

5.2.16 Areas of Zone C2 which inundate the central extent of the cable route corridor are covered by the Flood Watch area around the River Dee from Llangollen to Trevalyn Meadows.

Flood Defences

5.2.17 The NRW Flood Risk from River's map indicates no flood defences present in close proximity of the site.

Historical Flood Events

5.2.18 NRW Recorded flood extents mapping does not show any recorded flood events within the Site or to its immediate proximity.

5.2.19 The Wrexham County Council Flood Risk Management Plan (FRMP) was published in 2016 and aims to quantify the scale of the risk of local flooding across the County Borough and identifies locally relevant actions and measures to reduce flood risk into the future. FRMP highlights the areas most at risk from surface water and ordinary watercourse flooding in Wrexham CBC, draws conclusions from these risks and sets out the measures we will take over the next 6 years to mitigate these risks and make our communities more resilient. No polices directly relevant to the location of the site are listed.

5.3 Sea/Tidal Flood Risk Classification

5.3.1 The Development Advice Map indicates the site is outside of the risk of sea/tidal flooding.

5.4 Surface Water Flood Risk Classification

NRW Flood Risk

5.4.1 The NRW Flood Risk from Surface Water Map is presented within Figure 6 and demonstrates the Site has a predominantly 'very low' risk of flooding from surface water. This means that each year this area has a chance of flooding of less than 0.1%.

5.4.2 The risk classifications correspond to the following return periods:

- High risk – areas which have a chance of flooding greater than 1 in 30 year (3.3%);
- Medium risk – areas which have a chance of flooding between 1 in 100 year (1%) and 1 in 30 (3.3%);
- Low risk – areas which have a chance of flooding between 1 in 1000 year (0.1%) and 1 in 100 year (1%); and,
- Very low risk – areas which have a chance of flooding less than 1 in 1000 year (0.1%).

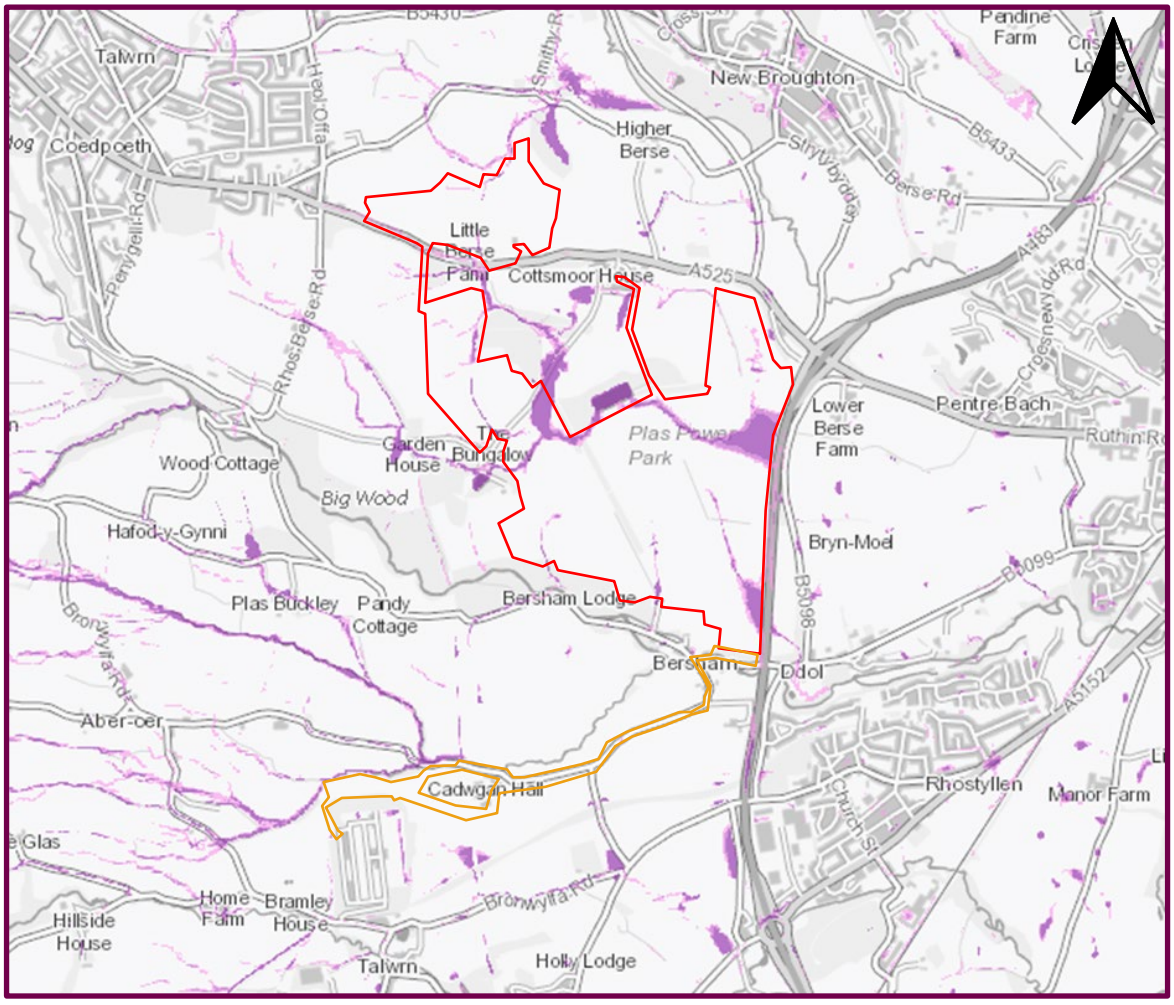


Figure 6. NRW Surface Water Flood Risk Map

5.4.3 Areas where there is an identified risk has been discussed in more detail in the relevant section below. Depth and velocity maps for the entire site for a high risk and medium risk scenario are included in **Appendix C.**

Northern Land Parcel

5.4.4 There are minor areas of risk along field boundaries in the centre of the site. The areas of flood risk are defined as 'low', 'medium' and 'high' risk. Depths of areas at risk are generally lower than 0.9m, there are minor areas in the centre where depths may exceed 0.9m during a high risk scenario. Velocities are generally under 1m/s during a high risk scenario, with a small area in the north at risk of velocities between 1m/s and 2m/s.

5.4.5 There are no significant surface water pathways, and the risk appears to be associated with minor isolated topographical depressions along the field boundaries. The depths and velocities are presented in Figure 7 and Figure 8 below for the northern land parcel.

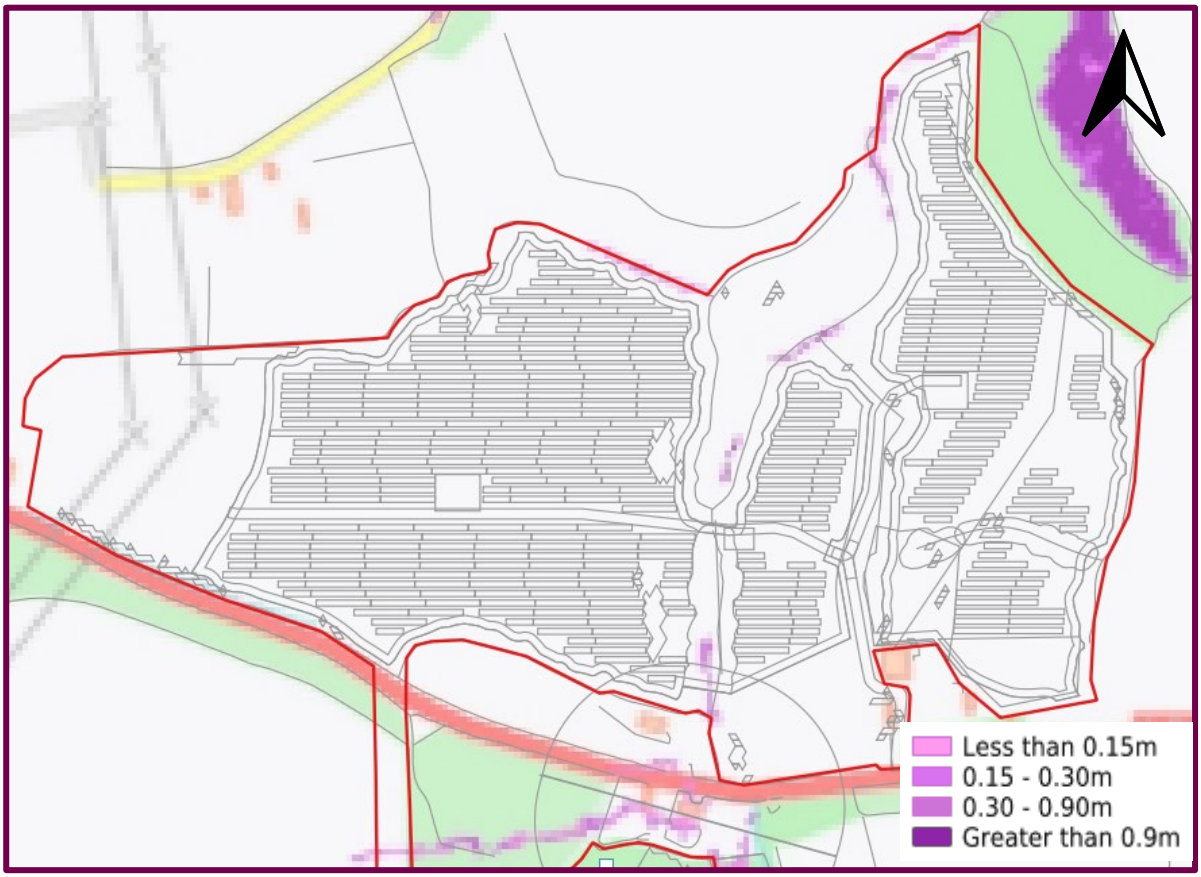


Figure 7. Surface water depths during a high risk scenario (Northern Land Parcel)

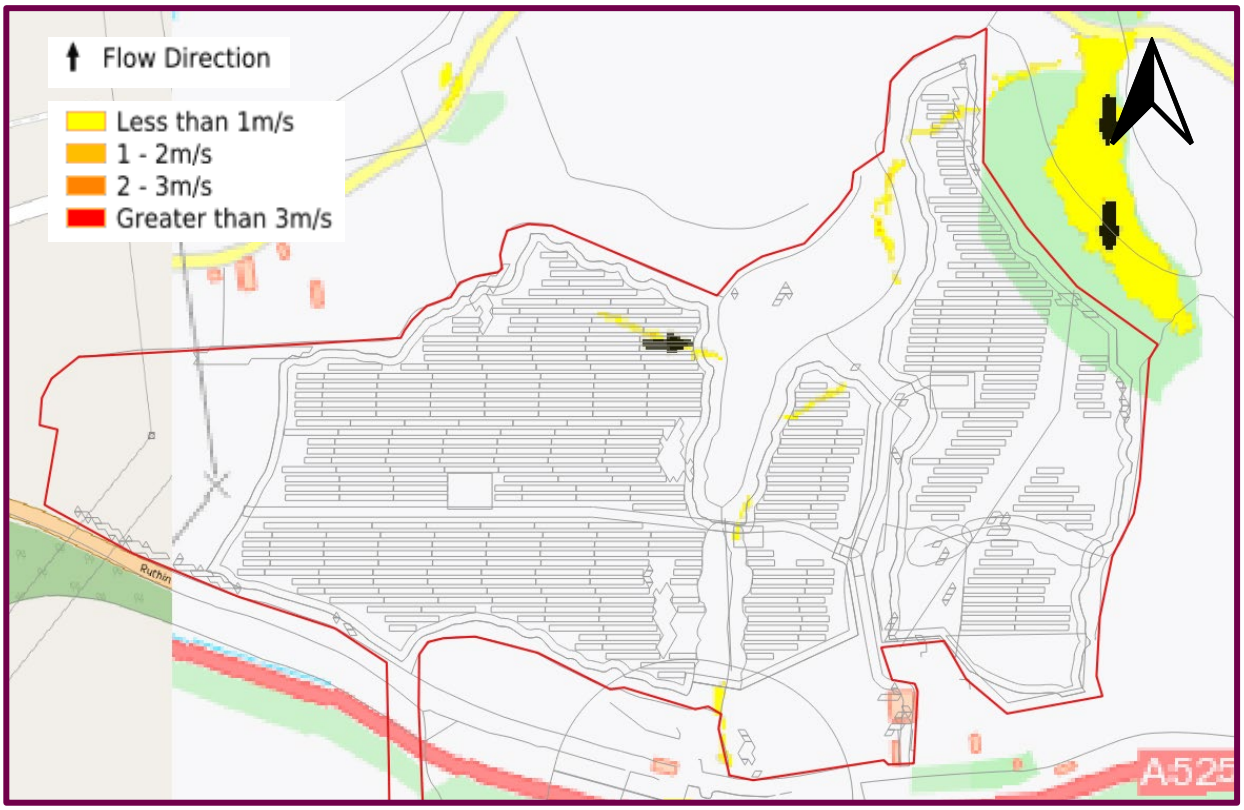


Figure 8. Surface water velocities during a high risk scenario (Northern Land Parcel)

Southern Land Parcel

5.4.6 There is a defined flow path which runs from the centre of the site flowing west to east and forms areas of 'low', 'medium', and 'high' risk of flooding. Adjacent north of the site is a pond where water collects with any exceeding water heading south east. The water then pools in area of risk adjacent to the eastern site boundary. The depths along the flow path are less than 0.15m during a high risk scenario, with the eastern boundary where water pools seeing depths exceeding 0.9m. In a medium risk the extents are greater.

5.4.7 Velocities are largely restricted to below 1m/s in a high risk scenario, with a small area of the flow path reaching between 1m/s and 2m/s. Where water pools the velocity remains below 1m/s. In a medium risk scenario there is a greater section of the flow pathway with velocities between 1m/s and 2m/s.

5.4.8 No ordinary watercourses or drainage ditches are located at this area of the site. The risk appears to be associated with the topography which slopes to the east, where there is a low lying dip where water pools.

5.4.9 In the north of this area of the site there is a further area of water pooling associated with a topographical depression. Water flows into the area from the south west and south east along overland flow pathways. The risk ranges from 'low', 'medium', and 'high' risk of surface water flooding.

5.4.10 The depths along the flow path are generally less than 0.3m, with a small area at 0.3m to 0.9m during a high risk scenario, with the area of pooling reaching depths exceeding 0.9m.

5.4.11 Velocities are less than 1m/s in a high risk scenario along the flow pathway. Where water pools the velocity remains below 1m/s. In a medium risk scenario, the overland flow pathways velocity may reach between 1m/s and 2m/s.

5.4.12 Flows are assumed to comprise of surface water runoff following high intensity rainfall events and following the elevation and local depressions of the land.

5.4.13 The depths and velocities are presented in Figure 9 and Figure 10 below for the southern land parcel.

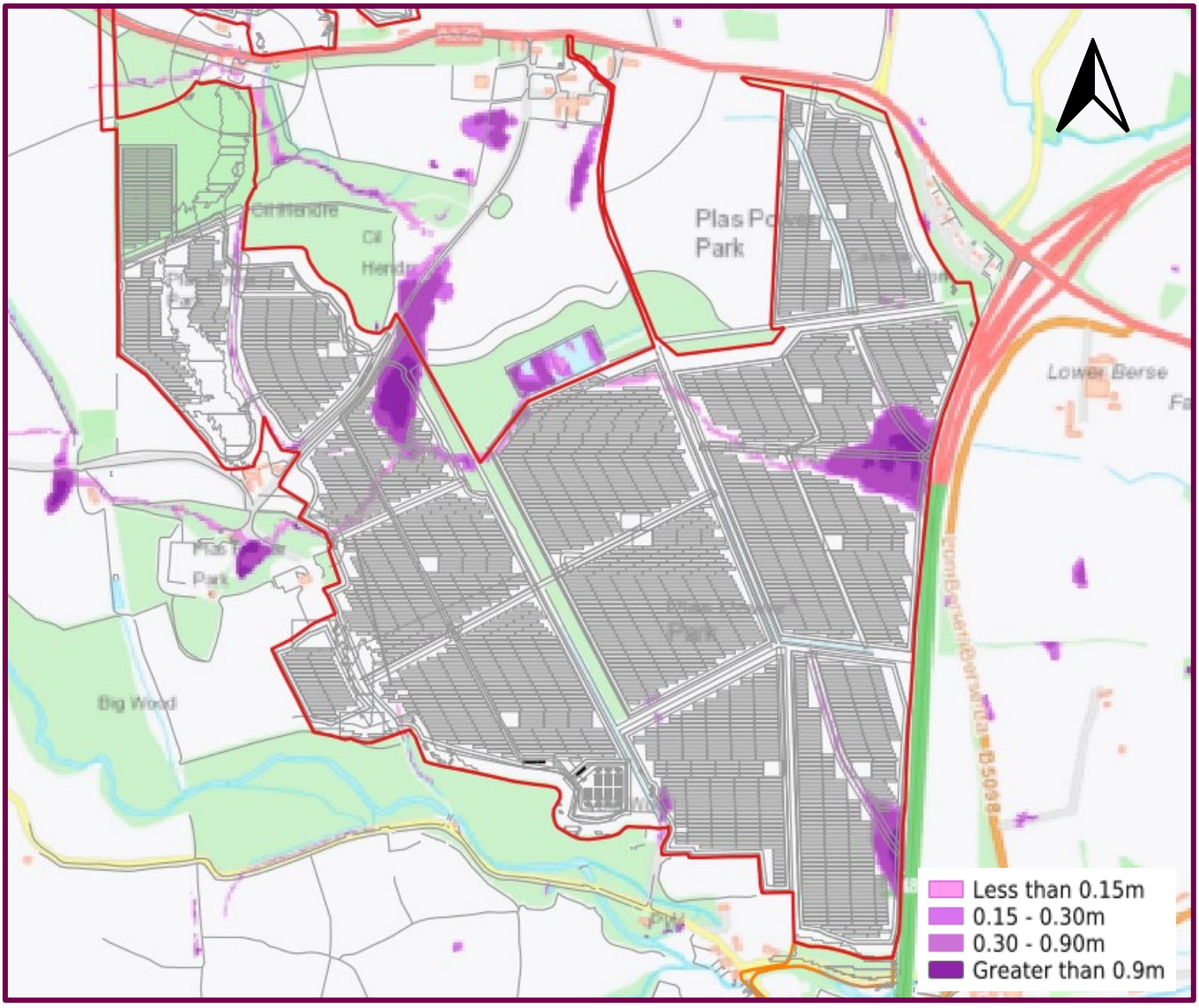


Figure 9. Surface water depths during a high risk scenario (Southern Land Parcel)

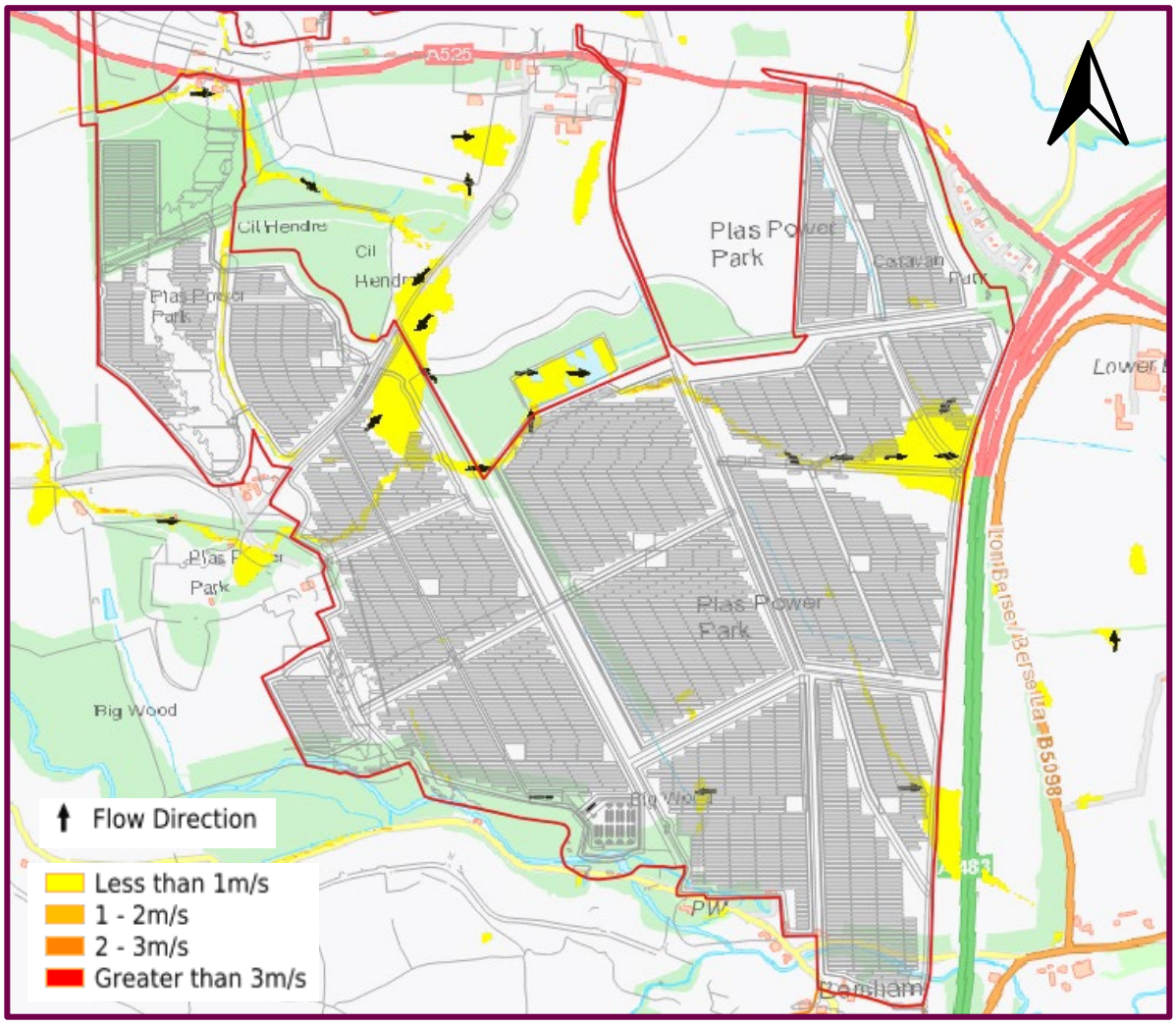


Figure 10. Surface water velocities during a high risk scenario (Southern Land Parcel)

Cable Corridor

5.4.14 The cable route corridor is predominantly located outside the extent of land at risk of flooding from this source. There are isolated areas at 'low' – 'high' risk of surface water flooding, associated with pond of surface water within topographical low points. Flood depths are up to 900mm and flow velocities are predominantly below 1m/s. Additionally, there is a surface water flow pathway which clips the central extent of the cable route corridor which presents a 'high' risk of surface water flooding, with flood depths up to 300mm and flow velocities are above 3m/s. Flooding appears to be associated with the conveyance of surface water flows along topography towards the unnamed tributary of the River Clywedog.

TAN15 Future Risk

5.4.15 The NRW's new Flood Map for Planning includes Flood Zones for surface water and small watercourses with consideration for climate change and how it will affect flood risk extents over the next century. As stated, the Flood Map for Planning has no official status for planning purposes until 2024.

5.4.16 However, the risk has been displayed in Figure 11 to show how the new modelling work undertaken and how climate change risk may impact the site in the future. The extent of the risk shows that risk

generally matches that of the present day, with small areas of the site in Flood Zone 2 and 3. The access tracks and cable route corridor cross Flood Zone 2 and 3.

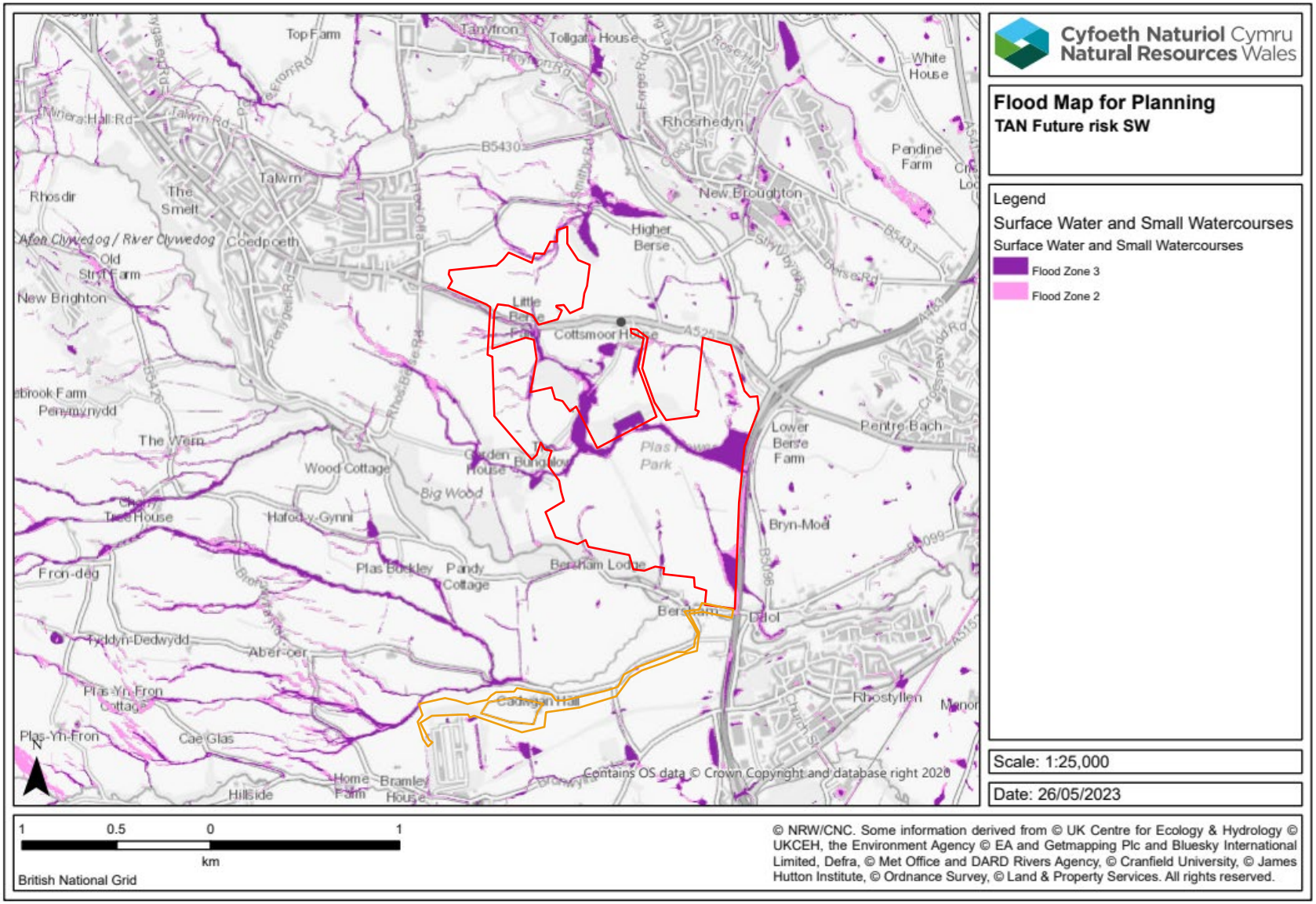


Figure 11. Flood Map for Planning Surface Water and Small Watercourses (Updated TAN15 mapping)

5.5 Reservoir Flooding

5.5.1 Reference to the NRW's Reservoir Flood Map indicates that the Ty Mawr Reservoir is located approximately 2.5 km south-west of the site. The northern and southern land parcels are located outside the mapped extent at risk of flooding from this source. Flooding from reservoirs however inundates the far eastern extent of the cable route corridor.

5.5.2 The NRW stipulates that a reservoir dam failure is an unlikely event. All large reservoirs are inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoir Act 1972 in England, the NRW ensure that reservoirs are inspected regularly, and essential safety work is carried out where required. Taking into account the above, it is considered the Site is at low risk of reservoir flooding.

5.6 Wrexham LFRMS and SFRA

5.6.1 Wrexham LFRMS has split the area into community areas, the site is situated within Coedpoeth community area. Of the 2029 properties in the area none are at fluvial risk from a 1 in 100 year or 1 in 1000 year event. 13 properties are at risk of surface water flooding from either/and a 1 in 30 year, 1 in 100 year and 1 in 1,000 year surface water event. The site is not currently developed so not incorporated in these property statistics.

6 HYDROGEOLOGICAL SETTING

6.1 Bedrock Geology

6.1.1 BGS Geology Viewer (1:50,000 scale) indicates that the bedrock geology varies across the site.

6.1.2 The northern extent of the site is comprised of Cefn Rock (sandstone) and Pennine Lower Coal Measures and Pennine Middle Coal Measures Formation (sandstone). The latter also underlays the southern extent of the site.

6.1.3 Numerous borehole records are noted on site. In the northern land parcel, borehole reference SJ25SE42 indicates that clay is present below soil; between 0.1 and 6m below ground level (bgl), below this is gravel up to 8.5m bgl, with sandstone until the base of the record at 9m bgl. No groundwater was struck during these records.

6.1.4 Borehole reference SJ35SW46 was recorded to reach a depth of approximately 59m bgl and comprised of sandstone, mudstone, and siltstone. No groundwater was struck during this record,

6.1.5 Therefore, this indicates that groundwater levels are not anticipated to be at or near the surface for the site area.

6.2 Superficial Deposits

6.2.1 The superficial geology deposits at the site are comprised of Till Devensian and Glaciofluvial Sheet Deposits, Devensian (sand and gravel).

6.2.2 Devensian Till is present across the majority of the site, including the majority of the southern parcel, and the south and northwest of the northern parcel of the site. Small outcrops of Glaciofluvial Sheet Deposits are noted across the site, largely in the south eastern corner of the southern parcel, as well as a small area in the west and the centre. The north eastern corner of the northern parcel of the site notes Glaciofluvial Sheet Deposits.

6.3 Hydrogeology

6.3.1 BGS Geology of Britain mapping shows multiple borehole records on site however, most of these were not available to view. Borehole reference SJ25SE42 indicates that water was struck at 151.2m bgl. No water was encountered within the borehole record SJ35SW46.

6.4 Aquifer Designation

6.4.1 BGS Aquifer Designation mapping shows bedrock deposits are categorised as Secondary A Aquifers which generally support water supply and base river flow on a more local scale. The underlying superficial geology deposits are classified as Secondary A Aquifers and Secondary Undifferentiated. Secondary Undifferentiated Aquifers have varying characteristics in different locations.

6.5 Surface Protection Zones

6.5.1 The NRW natural environment mapping shows the Site is located within an area of medium – high, medium – low, and low groundwater vulnerability and is not located within a Source Protection Zone.

6.6 Soils Classification

6.6.1 The National Soils Research Institute Soilscapes viewer classifies soils underlying the majority of the southern site boundary as loamy (restored soils mostly from quarry and opencast spoil). The

soils in the northwest of the southern boundary and northern boundary of site are classified as loamy and clayey (slowly permeable seasonally wet acid loamy and clayey soils).

7 FLOOD RISK VULNERABILITY CLASSIFICATION AND JUSTIFICATION TEST

7.1.1 In accordance with TAN15, solar farm and battery developments are classified as “Less Vulnerable”. Flood risk vulnerability and flood zone compatibility is presented below in Table 7-1.

Table 7-1. Flood Risk Vulnerability and Zone Compatibility

Flood Zone	Vulnerability Calassification		
	Emergency Services	Highly Vulnerable	Less Vulnerable
Zone A	Permitted	Permitted	Permitted
Zone B	If site levels are greater then flood levels, no need to consider risk further	If site levels are greater then flood levels, no need to consider risk further	If site levels are greater then flood levels, no need to consider risk further
Zone C1	Yes – if justification test applied	Yes - if justification test applied	Yes - if justification test applied
Zone C2	Not permitted	Not permitted	Yes - if justification test applied

7.2 Justification Test

7.2.1 TAN 15 technical guidance states a requirement for any proposed development within Zone C1 and Zone C2 to be subject to the Justification Test, including acceptability of consequences. The following must be demonstrated in order to justify development within Zone C:

i. “Development within zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; or,

ii. Development within zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;

And

iii. Development concurs with the aims of PPW and meets the definition of previously developed land; and,

iv. The potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable.”

7.2.2 The proposed development will contribute towards meeting the UK Government’s targets for generating energy from a renewable energy source; it will generate local employment during its construction and operation. Part ii of the justification test is therefore considered to be satisfied.

7.2.3 The proposed development located within Zone C is the cable corridor only. This is classified as ‘Less Vulnerable’. The percentage within Zone C2 is less than 1%.

7.2.4 Solar PV modules are to be installed within the northern and southern land parcels and will connect to the existing National Grid substation via the cable route corridor. Therefore, is unable to be routed without crossing areas within Zones C2. Part iii of the justification test is therefore considered to be satisfied.

7.2.5 In regard to part iv of the justification test, potential consequences of a flood event have been undertaken regarding development taking place within C2 in line with Appendix 1 of TAN 15.

7.2.6 The majority of the cable route corridor within Zone C2 is covered by the Flood Watch Area around the River Dee from Llangollen to Trevalyn Meadows. The cable route corridor within Zone C2 do not benefit from flood defences.

7.2.7 During the construction phase the site manager will sign up to the Flood Warning Service and will be alerted by a phone call or text when a Flood Warning becomes active. The flood warning will enable site personnel to be evacuated from the site in a timely manner prior to a flood event occurring.

7.2.8 The installation of below ground cables will be temporary in nature with no permeant above ground structures proposed. The majority of the construction works are not within previously developed land however, there will be no changes to existing land use. The cable route corridor does not increase flood risk to the surrounding area and has negligible risk of flooding to and from the development.

7.2.9 Any buildings to be located within Zone C2 during construction are expected to be limited to temporary office units and welfare facilities. Given the temporary nature of the buildings, flood resistant design is not considered to be appropriate.

7.2.10 Any alterations in the existing surface water drainage regime associated with the installation of the below ground cables are expected to be only during the construction stage and thus temporary in nature. Any increase in run-off during construction will be managed through the CoCP which will be submitted to the LLFA for approval with consultation with NRW prior to the commencement of works.

7.2.11 On this basis, the Justification Test is determined to be passed.

8 FLOOD RISK AND MITIGATION

8.1.1 The key sources of flooding that could potentially impact the site are discussed below:

8.2 Fluvial and Sea Flooding

8.2.1 In accordance with the Development Vulnerability Categories in Figure 15 of TAN15, solar farm and battery developments are classified as 'Less Vulnerable'.

8.2.2 The northern and southern land parcels and associated access roads are located entirely within Zone A. The cable route corridor has a small area within Zones B and C2.

8.2.3 The Flood Map for Planning shows the northern and southern land parcels, associated access roads and the majority of the cable route corridor to be located within Flood Zone 1. Limited areas of the cable route corridor located within Flood Zone 3.

8.2.4 All types of development are considered acceptable within Zone A and B. The justification test is considered to be passed for development located within Zone C2.

8.2.5 With the inclusion of the below mitigation measures, the Site is therefore assessed to have a low risk of flooding from this source.

Flood Mitigation Measures

8.2.6 During construction, site workers will be made aware of areas that are located within Flood Zone 3 / Zone C2 and of the evacuation protocol in the event of a flood. Stockpiled material and construction compounds will be located outside of the floodplain, minimising loss of floodplain storage area and reducing possibility of silt laden runoff into surrounding watercourses.

8.2.7 In accordance with Land Drainage (Wales) Byelaws, no persons shall without the consent of the authority, deposit or store objects or matters within 8m of the edge of drainage, watercourse and flood risk management features. No work will be carried out within 8 m of non-tidal water bodies unless agreed with the relevant drainage authority, NRW or LLFA.

8.2.8 Cable route crossing methods have yet to be determined. Mitigation measures to minimise any potential adverse effects on surrounding watercourses, increase in flood risk, degradation of agricultural land/ during construction will be ascertained in detailed design. Consent from NRW for any works within 8m of non-tidal waterbodies will also need to be obtained prior to any construction activities.

8.3 Surface Water Flooding and Ordinary Watercourses

8.3.1 The NRW Flood Risk from Surface Water map indicates the majority of the Site is located at very low risk of flooding. However, mapping does identify a low to high risk of flooding from surface water flow pathways across the site, predominantly across the centre of the site to the east, and in the south eastern corner of the site.

8.3.2 The extents of risk are similar in the Flood Map for Planning with Flood Zones 2 and 3 from surface water and small watercourses present across the site, associated with surface water flow pathways.

8.3.2 With the inclusion of the below mitigation measures, the Site is therefore assessed to have a very low risk of flooding from this source.

Flood Mitigation Measures

8.3.1 According to detailed mapping where these flow pathways are situated, the velocities are considered to be less than 2 m/s. Depths are largely below 900mm, which will be below the minimum height of solar panels which is to be at least 1m.

8.3.2 Development has been avoided in isolated areas where depths exceeds 900mm during a high or medium risk scenario. In addition, the proposed Conceptual Surface Water Drainage strategy has been designed to slow flow and intercept runoff to allow for a betterment in pre-existing conditions, see section 10.

8.3.3 No land raising activities are proposed with development and as such the levels at which solar panels will be set will reflect undulating Site topography. As no land raising is proposed, the Proposed Development will not interfere with the existing surface water runoff and flows paths currently present within the undeveloped Site and will remain unaltered with Proposed Development.

8.3.3 Solar PV modules are mounted on the array framework, often but not always stacked in a portrait or landscape layout. The panels themselves are waterproof with a minimum IP64 rating and meant to be exposed to the elements. The photovoltaic energy generation process is passive and does not require moving parts. The only element of a solar panel that could be impacted by water is the “junction box” in the middle (on the rear of) each panel. These allow each panel to connect to the other in ‘strings’. Junction boxes are rated to either IP67 or IP68 meaning they would be able to withstand immersion in up to 1m of water. Even if this occurs, the panels themselves would remain operational, however, junction boxes would potentially be compromised and could require minor electrical works to replace once flood waters had subsided. As such, solar arrays themselves should not be considered vulnerable to flood risk.

8.3.4 The only elements vulnerable to flooding are ancillary buildings with electrical equipment. None of the buildings are proposed in areas where there is a surface water flood risk. These buildings are primarily prefabricated container units. They can be raised off the ground so there is a void between the ground and floor level of the unit, with internal electrical equipment therein also not situated directly on the floor of the unit.

8.3.1 There will be some cut and filling as part of the BESS storage, but a slight gradient will remain to allow water to flow towards the pond. In addition, the BESS is placed outside of any surface water risk and therefore, is not anticipated to impact any surface water flows. The attenuation pond allows for a betterment to pre-conditions.

8.3.5 Access tracks cross areas where depths are largely below 300mm. The access tracks are to be primarily formed of permeable material’ loose gravel. Where a risk is identified, it is recommended to camber the roads to prevent water pooling to ensure access can be maintained. The residual effect of the Proposed Development on flood risk is therefore considered to be negligible. The solar farm and battery site will be safe for its lifetime, taking account of the limited number of users of the Site with no increase in flood risk elsewhere.

8.4 Other Sources

8.4.1 Drains are situated in the south and east of the southern land parcel, these are generally shallow in nature. These are associated with the agricultural nature of the site and flow in an easterly direction away from the site. It is anticipated these drains will remain as is, and therefore should be regularly inspected to ensure they remain blockage free.

8.4.2 Where access tracks are proposed these do not cross on-site drains and therefore, no further mitigation is proposed.

8.4.3 We have been informed from consultation that there is a highway drain located on Ruthin Road to the south of the northern land parcel. This cannot be identified from street view imagery. However, from reviewing the catchment of the northern parcel water flows easterly away from the highway to the river tributaries. As such runoff from the site to the road is not anticipated. However, we have placed a swale along the edge of this field boundary to capture exceedance runoff. This is also designed to slow runoff from the fields, to reduce the risk to the properties adjacent south of the northern land parcel. This design enables a betterment to pre-existing drainage conditions.

8.4.4 Due to the type of development proposed, the Site is assessed to have a very low risk of flooding from groundwater and sewer flooding and a negligible risk of flooding from reservoirs. No mitigation measures are proposed.

9 POTENTIAL IMPACTS

9.1 Impermeable areas

Solar Arrays

9.1.1 The majority of the Plas Power Solar Farm and Battery Project will be occupied by solar arrays. Although arrays have a large land take, the actual ground impact is negligible. The only intrusion will be from the pile-driven posts. There will be one post for about 6-7 panels, so likely to be 6-7m between each post. Posts are made of galvanized steel and are not solid poles. Traditional fixed solar arrays have surface area ground impact in the range of 0.0012 m^2 - 0.0014 m^2. The number of the modules in this solar farm would be approximately 149,100 with a panel width of 1.3 m. Assuming that there will be posts every 6 m the total number of posts would be 32,305.

9.1.2 Based on this, if the 0.0014 m^2 per post is assumed, the total solar farm ground impact would be 45.2 m^2 on a 136ha (1,355,397m^2) Site. This means that what covers the majority of the land as “development” will have a ground impact of approximately 0.00% of the Site.

Ancillary Features

Inverters, Transformers and Switchgear Substations.

9.1.3 A conservative assumption notes that a total of 26 Central Inverters will be placed across the site. The Central Inverters are 8.2m (L) and 2m (W). Per Central Inverters the area is 16.4m^2. As such the total conservative impermeable area from Central Inverters is 426.4m^2.

9.1.4 A total of 26 Transformers will be placed across the site. The Transformers are 5.5m (L) and 4.5m (W). Per transformer the area is 24.8m^2. As such the total conservative impermeable area from transformers is 643.5m^2.

9.1.5 A total of 13 Switchgear Substations will be placed across the site. The Switchgear Substations are 4.2m (L) and 2.6m (W). Per Switchgear Substation the area is 10.9m^2. As such the total conservative impermeable area from Switchgear Substations is 142m^2.

9.1.6 Therefore, the above will create a total of 1211.9m^2 of new impermeable areas within the site which equates to a ground impact of 0.09% across the site.

Auxiliary Transformer

9.1.7 1no. Auxiliary Transformer is proposed. The Transformer is proposed to have 3.8m (L) and 3.8m (W). Per transformer the area is 14.4m^2.

9.1.8 Therefore, the Auxiliary Transformer will create a total of 14.4m^2 of new impermeable areas within the site which equates to a ground impact of 0.001% across the site.

Substations

9.1.9 1no. Customer Substation is proposed. The Substation is proposed to have 10.3m (L) and 5m (W). Per Substation the area is 51.5m^2.

9.1.10 1no. PV intake substation is proposed. This is anticipated to be up to approximately 10.5m (L) x 2.5m (W), a total area of approximately 26.3m^2.

9.1.11 1no. GRP Substation is proposed. This is anticipated to be approximately 3.0m (L) x 3.0m (W), a total area of approximately 9.0m^2.

9.1.12 Therefore, substations will create a total of 86.8m^2 of new impermeable areas within the site which equates to a ground impact of 0.006% across the site.

Spares Container

9.1.13 1no. Spares Container will be located at the site. This is anticipated to be approximately 12.4m (L) x 2.6m (W), a total area of 32.2m^2. Therefore, the spares container will create a total of 32.2m^2 of new impermeable areas within the site which equates to a ground impact of 0.002% across the site.

Monitoring House

9.1.14 1no. Monitoring House will be located at the site. This is anticipated to be approximately 3.9m (L) x 3.2m (W), a total area of 12.5m^2.

9.1.15 Therefore, the Monitoring House will create a total of 12.5m^2 of new impermeable areas within the site which equates to a ground impact of 0.001% across the site.

BESS Components

9.1.16 The BESS area will be lined to ensure that in the unlikely event of a fire water event runoff does not infiltrate into the below ground. The total lined BESS area is 3,900 m^2. This

9.1.17 equates to a ground impact of 0.29% across the site.

Access Tracks

9.1.2 It is proposed that the internal access tracks will be comprised of gravel and fully permeable with no tarmac or other hardstanding type surface. Most will follow existing farm tracks so would not even be new access routes. As such they will have no impact with respect to surface water drainage. Geotextile membrane layers will help to secure the aggregate to prevent it sinking into the soil and this will help prevent ground compaction.

9.1.3 After the construction of the solar farm and battery the heaviest vehicles likely to use the tracks are occasional van or 4x4 type vehicles. There will be less intensive traffic around the Site compared to existing farm use. This means there is low risk of over-use causing compaction that could compromise permeability. Despite this, it will be reasonable to include monitoring and maintenance of the internal accesses over the lifetime of the solar farm and battery site.

9.1.4 In construction there will be no HGVs using the internal access tracks around the Site except from the highway into the Site. All HGVs making deliveries to the Site for construction will drop off in temporary construction compounds at the access point, to be shown on design and layout drawings. Materials will then be delivered around the Site by tractor-trailer type vehicles which are the same as vehicles that currently use these routes around the working farm. This means there is low risk of traffic/vehicles causing excess soil compaction either in construction or during operation which could limit the efficacy of the tracks' permeability.

9.2 Summary

9.2.1 The proposed impermeable surface areas within the 136 ha (1,355,397m^2) site is presented within Table 9-1 below. In total, the new impermeable areas create a ground impact across 4,735m^2/0.35% of the site.

Table 9-1. Impermeable areas

Development	Area (m^2)
Solar PV module posts	45.2
Inverters, Transformers and Switchgear Substations	657.9

Substations	86.8
Spares ContainerS	32.2
Monitoring house	12.5
BESS	3,900
Total	**4,735**

10 SURFACE WATER MANAGEMENT

10.1 Introduction

10.1.1 New potential impermeable areas within the site are equivalent to 4,735m^2/0.35% of the whole Site area.

10.1.2 The sustainable management of surface water is an essential element of reducing future flood risk to the site and its surroundings. Legislation and guidance relating to sustainable drainage systems are presented within Section 2, legislation and guidance.

10.1.3 Undeveloped sites generally rely on natural drainage to convey or absorb rainfall, with water infiltrating into the ground or coalescing across the surface towards watercourses.

10.1.4 Modelling work (Cook and McCuen 2013) shows that solar panels themselves do not have a significant effect on runoff volumes, peak flows or times to peak. However, where design decisions or lack of maintenance lead to bare ground then the peak discharge may increase requiring storm water management.

10.1.5 Ancillary features are expected to increase hardstanding within each site. Reducing the permeability of at least part of the site will however lead to marked changes in each site's response to rainfall. Without specific measures to manage surface water the volume of water and peak flow rate are likely to increase. Inadequate surface water drainage arrangements can threaten the Project itself and increase the risk of flooding to others.

10.1.6 Surface water arising from a developed site should as far as is practicable be managed in a sustainable manner to mimic the natural hydrology of the site while reducing the risk of flooding and elsewhere, taking climate change into account.

10.1.7 Generally, this type of development is considered to have a design life of 40 years. Therefore, for the purposes of this assessment, taking into account Wales climate change allowances a 20 % increase in peak rainfall intensity has been included as climate change allowance, which caters up to the year 2115. No climate change guidance is available beyond 2115.

10.2 Existing Surface Water Runoff Rates

Greenfield Runoff Rate

10.2.1 The existing runoff rate has been calculated using the Interim Code of Practice for Sustainable Drainage Systems (ICP SuDS) Method. Existing greenfield runoff rates are presented in Table 10-1. Existing surface water run-off rates per hectare are listed below. ICP SuDS calculations are included as **Appendix D.**

- Area: 1ha
- Standard-period Average Annual Rainfall: 967 mm/yr
- Soil (global soils index): 0.3
- Region number: 9 (catchment based on Flood Studies Report Figure I.2.4.).

Table 10-1. Existing surface water run-off rates

Return period (years)	Runoff rate (l/s/ha)*
1 in 1	2.3
QBAR**	2.7
1 in 30	4.7
1 in 100	5.8

**l/s = litres per second*
***Mean Annual Flood*

10.2 The presence of solar panels and associated ancillary buildings will result in total potential new impermeable surfaces 5,149m^2/0.3% of the whole site area. If a conservative approach is adopted, it is assumed that the ancillary buildings will entail new hardstanding within the site.

10.3 Proposed Development Conceptual Drainage Strategy

10.3.1 A conceptual drainage strategy is based on the Proposed Development Layout as presented within **Appendix E**. The discharge location and method of surface water flows is to be determined at detailed design stage, following soakaway testing.

Solar Panels

10.3.2 It is expected precipitation would be intercepted by between 25% to 40% of the surface of the site typically over-sailed by solar PV modules. A known concern is the risk of water “sheeting” off a solar array façade. As a result of the construction of the solar panels, some rainfall will be intercepted by the surface of the arrays before reaching ground level. Intercepted rainfall will either run down the face of the panels and drip onto the ground below or will be lost due to evaporation from the face of the panels. Without mitigation there is a risk of erosion of the ground on which rainwater drips. This could then result in the formation of rivulets which could increase the speed at which runoff discharges from the site.

10.3.3 However, the potential for erosion to occur as a result of the ‘drip effect’ is appropriately mitigated by features of the solar arrays themselves, typical solar arrays are constructed with gaps between each panel on an array which allows surface water to fall to the vegetated ground beneath.

10.3.4 As presented within Figure 12 and **Appendix B.3**, the solar PV modules for Plas Power are to have a 25 degree pitch on the horizontal plane. This will reduce the flow velocity of run-off landing on the solar PV modules, resulting in run-off to drip down through gaps between individual panels and thus reducing the risk of water sheeting and run-off from the lower edge of the modules. Figure 13 is from the underside of a typical array providing a helpful visual aid to show what the gaps are like. These images are provided for context and comparison only.

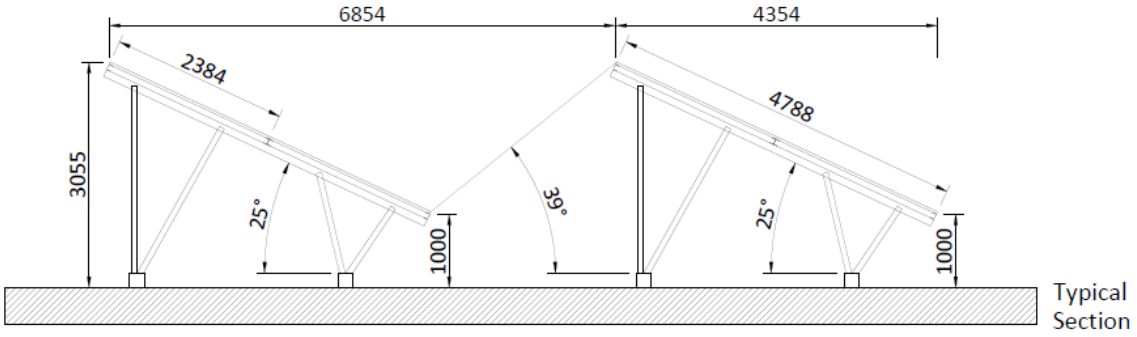


Figure 12. Plas Power solar panel



Figure 13 Typical underside of a solar panel

Filter strips

10.3.5 Filter strip SuDS comprising of appropriate seeded vegetation will be provided below and between rows of the solar PV modules to dissipate energy of surface water and promote low erosivity sheet flow during operation of the Project. The vegetation will be managed organically and will either be mowed or used for light grazing. The grassland will not only grow between array gaps.

10.3.6 It is expected grassed areas will be managed through quarterly mowing, especially in the early years while the newly operational solar farm is “bedding in”. Year-round ground coverage is an improvement with respect to surface water infiltration compared to existing arable use where the ground is regularly bare following crop harvest. Filter strips are presented within **Appendix E** the Conceptual Drainage Layout.

Swales

10.3.7 Swales (interceptor channels) comprising of appropriately seeded vegetation will be provided along the downstream perimeter of solar PV module parcels to capture and attenuate any exceedance flows from solar PV modules following high intensity rainfall events. Swales are presented within **Appendix E** the Conceptual Drainage Layout. The sizing and discharge location of swales are subject to detailed drainage design and soakaway testing.

BESS Components

10.3.8 The report takes a conservative approach and suggests that the BESS components on site will entail new hardstanding. However, this is not entirely accurate. The ancillary features comprise of prefabricated containers. They are not intended as permanent buildings as the site will require full reinstatement of the land to agricultural use at the end of the site's operational life. Therefore, there is no interest in creating any kind of permanent foundation for the temporary ancillary features. No poured concrete or other non-permeable foundation will be used.

10.3.9 The containers must have a floor level that is off the ground by at least 100mm and they are typically located on plinths or blocks 100-500mm off the ground. Within the proposed development, the containers will sit atop a 300mm deep gravel base with a 500mm void between the floor level of the unit and the permeable foundation beneath. Therefore, the only impermeable surface would be the area of blocks that stabilise the invertors on the gravel base.

10.3.10 Management of Fire Water

10.3.11 In order to manage the risk associated with a highly unlikely fire event, the development will include both a provision for the supply of fire water via water tanks and/or hydrants, in addition containment of fire water used to supress any fire. The site will use hydrants and appropriate consideration of the containment of this fire water is required. It has been agreed with the local fire department that a nearby hydrant can be used at the site, and that water can be recycled by the fire department in the unlikely event of a fire.

10.3.12 The guidance regarding fire water containment for BESS developments is currently limited. The Essex Fire Water Department provides useful advice for the management of fire water specifically for BESS developments (https://www.essex-fire.gov.uk/fire-service-guidance-bess-developers).

10.3.13 Ensure that sufficient water is available for manual firefighting. An external fire hydrant should be in close proximity of the BESS containers. The water supply should be able to provide a minimum of 1,900 l/min for at least 120 minutes (2 hours). Further hydrants should be strategically located across the development. These should be tested and serviced at regular intervals by the operator. If the site is remote from a pressure fed water supply, then an Emergency Water Supply (EWS) meeting the above standard should be incorporated into the design of the site e.g. an open water source and/or tank(s). If above ground EWS tanks are installed, these should include facilities for the fire service to discharge (140/100mm RT outlet) and refill the tank.

10.3.14 This equates to 228m^3 of water for a fire event. Guidance received from Oxfordshire Fire and Rescue Service for a similar BESS development site recommended a contingency of an additional 122m^3. Therefore, it is recommended that an estimated 350m^3 is accounted for in the event of a fire.

10.2 An onsite fire containment strategy will be incorporated into the overall site drainage design. The attenuation pond will be designed to accommodate the required fire water. In the unlikely event of a fire the unit on fire will be left to burn out, in accordance with general guidance for Battery units, whilst water will be focussed on the adjacent battery units to ensure the fire is contained. As a consequence, the runoff generated is less likely to pose a contamination risk. A penstock will be installed downstream of the pond to allow further containment of potentially contaminated water for testing prior to either tanking offsite if contaminated, or alternatively discharged in accordance with the approved drainage strategy.

Attenuation basin

10.3.1 Taking forward a conservative approach to surface water attenuation, the impermeable area of the lined BESS area has been taken forward within drainage calculations. Based on a conservative assumption of an impermeable area of 3900m^{2}0.39ha, approximately 245m^3 of attenuation will be required to accommodate flows from the 1 in 100 critical storm event, with an uplift to account for climate change. Accounting for the required fire water storage an additional 350m^3 is required. Calculations are presented within **Appendix E**.

10.3.2 This is proposed to be attenuated within a 1m deep attenuation basin with 300mm easement strip and discharge to an ordinary watercourse directly adjacent to the basin. It is proposed to restrict this to 2l/s. The greenfield runoff rate is 0.86 l/s but, to allow for self-cleansing 2 l/s is deemed acceptable. The cover level will be 117m AOD with an invert level of 116m AOD. The attenuation basin is presented within **Appendix E** the Conceptual Drainage Layout.

Ancillary Features

10.3.3 The report takes a conservative approach and suggests that the ancillary buildings on site will entail new hardstanding. However, this is not entirely accurate. The ancillary features comprise of prefabricated containers. They are not intended as permanent buildings as the site will require full reinstatement of the land to agricultural use at the end of the site's operational life. Therefore, there is no interest in creating any kind of permanent foundation for the temporary ancillary features. No poured concrete or other non-permeable foundation will be used.

10.3.4 The containers must have a floor level that is off the ground by at least 100mm and they are typically located on plinths or blocks 100-500mm off the ground. Within the proposed development, the containers will sit atop a 300mm deep gravel base with a 500mm void between the floor level of the unit and the permeable foundation beneath. Therefore, the only impermeable surface would be the area of blocks that stabilise the invertors on the gravel base.

Gravel bases

10.3.5 Each ancillary feature unit is to be placed upon a permeable gravel-filled infiltration blanket filled with a 30% void ratio to provide surface water attenuation. The gravel base will not alter the underlying condition beyond the topsoil; what would otherwise be topsoil will be replaced by gravel, which has 30% more porosity and storage capacity than the existing topsoil would have.

10.3.6 Conceptual drainage calculations have been undertaken using the industry standard MicroDrainage software to assess indicative dimensions of the gravel bases to accommodate attenuation requirements for the 1 in 100-year critical storm event plus a 20% climate change uplift. A summary of the results are presented in Table 10-2 and Calculations are presented within **Appendix F**. Due to the modelling resolution of the software, impermeable areas have been modelled at 10m^2 increments.

Table 10-2 Attenuation requirements and volumes

Impermeable area	Area of each unit (m^2)	Attenuation required (m^3)	Indicative required dimensions of gravel base(m^3)
Inverters	16.4	3.0	8.2 * 2 * 0.3
Transformers	24.8	3.0	5.5 * 4.5 * 0.3
Switchgear Substation	10.9	1.5	4.2 * 2.6 * 0.3
Auxiliary Transformer	14.4	3.0	3.8 * 3.8 * 0.3

PV Substation	26.3	3.0	10.5 * 2.5 * 0.3
Customer Substation	51.5	7.5	10.3 * 5 * 0.3
GRP Cabinet	9.0	1.5	3 * 3 * 0.3
Spares Container	32.2	4.5	12.4 * 2.6 * 0.3
Monitoring House	12.5	3.0	3.9 * 3.2 * 0.3

Access Tracks

10.3.7 It is proposed that the internal access tracks will be fully permeable with no tarmac or other hardstanding type surface. Most will follow existing farm tracks so would not even be new access routes. As such they will have no impact with respect to surface water drainage. Geotextile membrane layers will help to secure the aggregate to prevent it sinking into the soil and this will help prevent ground compaction.

10.3.8 After the construction of the solar farm and battery the heaviest vehicles likely to use the tracks are occasional van or 4x4 type vehicles. There will be less intensive traffic around the site compared to existing farm use. This means there is low risk of over-use causing compaction that could compromise permeability. Despite this, it will be reasonable to include monitoring and maintenance of the internal accesses over the lifetime of the solar farm and battery.

10.3.9 In construction there will be no HGVs using the internal access tracks around the Site except from the highway into the Site. All HGVs making deliveries to the site for construction will drop off in temporary construction compounds at the access point. Materials will then be delivered around the site by tractor-trailer type vehicles which are the same as vehicles that currently use these routes around the working farm. This means there is low risk of traffic/vehicles causing excess soil compaction either in construction or during operation which could limit the efficacy of the tracks' permeability. Based on the above no attenuation is required.

10.4 SuDS Maintenance

10.4.1 Table 10-3 below shows the typical drainage maintenance plan suitable for gravel bases (extracted from SuDS Manual C753).

Table 10-3 Gravel base maintenance

Maintenance schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly, or as required
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect gravel for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from gravel	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the gravel (if applicable), using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required

10.4.2 Table 10-4 below shows a typical drainage maintenance plan suitable for filter strips (extracted from SuDS Manual C753).

Table 10-4 Filter Strip maintenance

Maintenance schedule	Required Action	Typical Frequency
Regular maintenance	Mow amenity grass access paths	Monthly, or as required
	Mow filter strips	Monthly, or as required
	Where marsh or wetland develops due to wet conditions then cut annually, or as required, at 100mm cuttings to wildlife piles on site	Annually or as required
Occasional maintenance	Where there is a build-up of silt on the filter strip, remove and spread on site	As required
Remedial factors	All damage to be made good to design profile unless there is a design flaw.	As required

10.4.3 Table 10-5 below shows a typical drainage maintenance plan suitable for attenuation basin (extracted from SuDS Manual C753).

Table 10-5 Basin maintenance

Maintenance schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	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
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 factors	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required

10.5 Water Quality

10.5.1 Compared to agricultural (arable and livestock) use, the solar aspects are likely to create an overall betterment in surface water drainage than a continuation of the existing use.

10.5.2 The primary reason for this is the significant advantage from full year-round organically managed vegetated ground cover on within solar PV module areas compared with intensive arable or livestock grazing uses. Research undertaken by Cook and McCuen (2013) found that provided full vegetation cover beneath the solar modules is maintained, the change in run-off characteristics from solar PV module areas is likely to be insignificant and that ground cover has a much more important control over runoff.

10.5.3 A second environmental benefit of solar PV modules are soil quality improvement from cessation of intensive arable use and organic management of the land. It is expected that soil health will be improved through increase in soil organic matter, increase in the diversity of soil flora, fauna and microbes, and improved soil structure. The ceasing of intensive agricultural practices during operation of the solar farm will likely result in an improvement in the quality of surface water runoff generated within the site as a result of reduced sediment loadings, phosphorous and nutrients.

10.5.4 When the operational phase ends, the Project will be decommissioned. The anticipated period of operation and decommissioning is 40 years. Solar PV modules, mounting structures, cabling, inverters and transformers will be removed from the site and recycled or disposed of in accordance with good practice and market conditions at that time. All of the elements of solar PV modules can be removed with minimal topsoil disturbance which should leave the improved and enriched soil as a benefit for the return to arable use.

10.5.5 As the land will be returned to full agricultural after the expiration of the solar farm and battery consent, Sustainable drainage system features that require a straightforward restoration to existing agricultural use with minimal ground disturbance or disruption to new and improved ecological features.

10.6 Event Exceedance

10.6.1 The proposed surface water drainage strategy caters for the 1 in 100 year plus 20% climate change event. In the event the attenuation measures reach capacity excess water will overtop and be conveyed by gravity across the fields mimicking the existing Site runoff characteristics. This approach will aid in managing flood flows, whilst at the same time ensuring that the vegetated ground cover and existing and new boundary vegetation receive suitable hydration.

10.6.2 Solar farm components are not vulnerable in the event of exceedances. There is no need to mitigate a risk that does not exist, or for infiltration testing when there is no reason to expect a negative impact on the current baseline and every reason to expect at least modest betterment from gravel storage vs. topsoil storage.

10.6.3 Without introducing new unnatural SuDS within the majority of the Site, there will be betterment from full year-round vegetated ground cover compared existing intensive arable use. Aforementioned Cook and McCuen (2013) research advises that vegetated ground should be provided under and around arrays and maintained to avoid bare earth, but as long as this is done a solar farm has no impact on runoff characteristics.

10.6.4 The SuDS scheme for the project will therefore prioritise nature-based solutions for flood risk mitigation as opposed to unnatural elements that might compromise the multifunctional benefits of the cessation of arable farming and green infrastructure enhancement. Beyond attenuation for the ancillary units the remainder of the SuDS will be the natural filter strips between rows, the vegetated ground under arrays and the existing plus new landscape planting boundary treatments.

10.6.5 In support of this strategy overland flow, a pre-development and post-development exceedance flow plan drawing has been produced and is presented within **Appendix G**, the Exceedance Flow Plan drawing.

11 SUMMARY AND CONCLUSIONS

11.1.1 A site-specific Flood Consequence Assessment following the guidance of the Planning Policy Wales and TAN 15 has been prepared for a solar farm and battery project on land at Plas Power, Wrexham.

11.2 Flood Risk Appraisal

11.2.1 The northern and southern land parcels in which solar PV modules and associated ancillary features will be situated is located entirely within Flood Zone 1 / Zone A. Permeant and temporary site access is also located within this zone.

11.2.2 The cable route corridor is predominantly located within Flood Zone 1 / Zone A. Limited areas are located within Flood Zone 3 / Zone C2.

11.2.3 The proposed development is classified to be 'Less Vulnerable'. The Justification Test has been applied to proposed development (cable route) located within Zone C2 and is considered to be passed.

11.2.4 There are several surface water flow pathways within the site where the risk is moderate or above. The placement of development features has avoided these areas.

11.3 Surface Water and Soil Management Measures

11.3.1 The Proposed Development is expected to increase impermeable areas within the site by 4,735m^2/0.35% of the total site area. A SuDS strategy has been produced to incorporate appropriate management techniques that will mitigate potential increase in runoff from the Proposed Development.

11.3.2 SuDS techniques include filter strips, swales and attenuation for ancillary features is proposed via gravel basis in which infrastructure will be located upon. Access tracks will be constructed out of permeable materials.

11.3.3 Solar PV arrays are designed in such a way to prevent surface water sheeting off panels and potentially causing erosion. Panels are designed to allow surface water to drip off, landing onto filter strips below.

11.3.4 An attenuation pond is included to accommodate the 100 year plus climate change event for the BESS development area which will be lined. The pond will also accommodate the required fire water volume during the unlikely event of a fire.

11.3.5 The surface water and soil management measures incorporated within the Proposed Development will ensure that there is negligible alteration to local drainage patterns, flow directions and will manage suspended sediments from entering the drainage channels.

11.3.6 Where construction has resulted in soil compaction, the areas between panel rows would be tilled / scarified to an appropriate depth and then re-seeded with an appropriate vegetation cover. Any existing field or tile drainage system will be restored, where affected by construction will be maintained by the client for the life of the development. Furthermore, all areas of the application area, where appropriate, will have vegetation cover at all times.

11.3.7 All ancillary features will be placed on a gravel subbase sized to accommodate the 100 year + 20% CC critical storm event. An attenuation pond is to accommodate any additional runoff from the BESS if it is to be included within the final plans.

11.4 Conclusion

11.4.1 The FCA demonstrates that the site has been appropriately mitigated against all sources of flooding. The following conclusions can be made:

- Development will be restricted to areas at a very low and low risk of flooding.
- The Proposed Development will neither exacerbate existing flooding problems nor increase the risk of flooding on Site or elsewhere.
- Surface water runoff will be mitigated by maintenance of a vegetation cover and SuDS features; and
- With appropriate surface water and soil management measures there is negligible alteration to local drainage patterns direction within the Site.

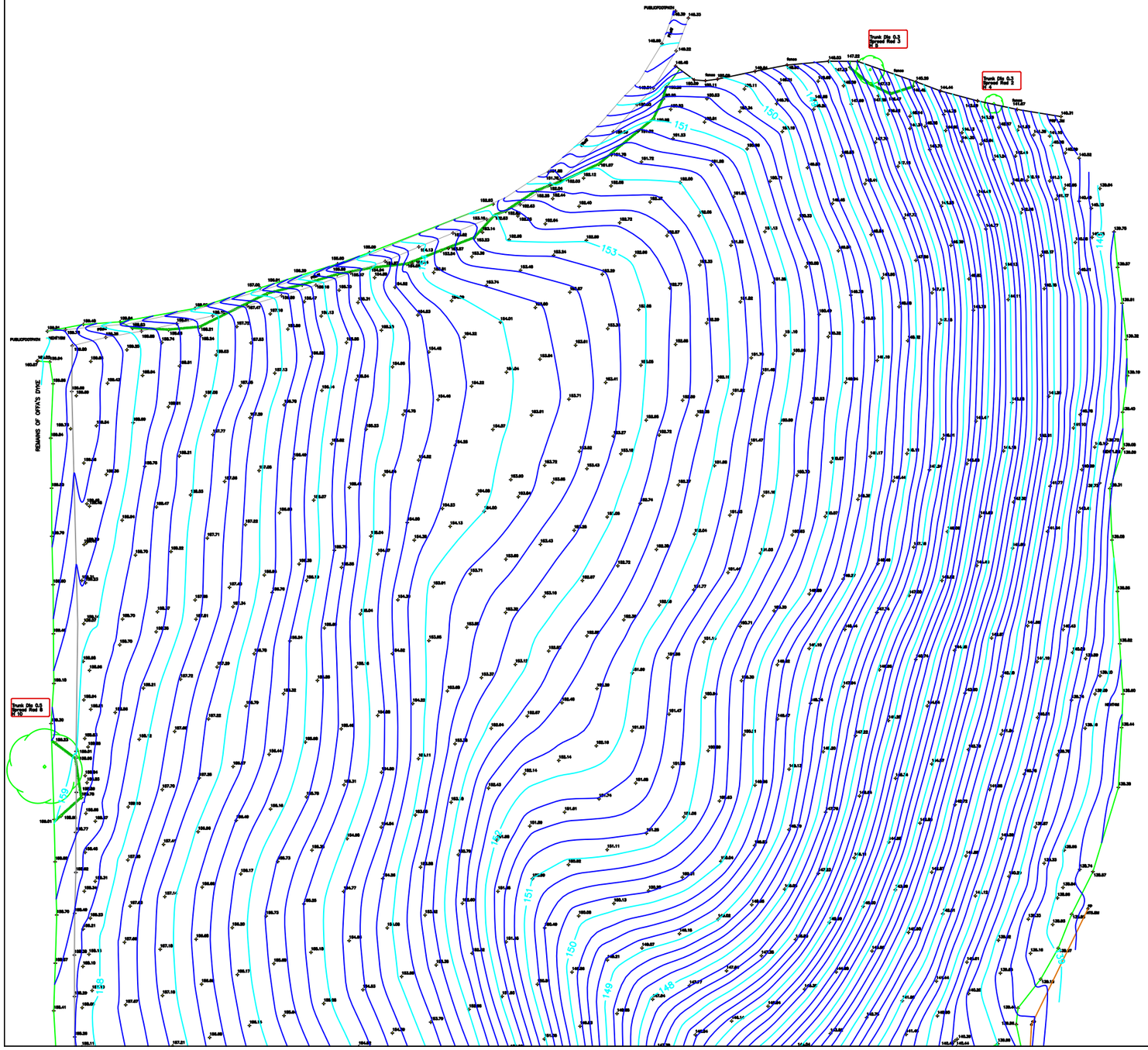
11.4.2 The residual effect of the development on flood risk is therefore considered to be negligible. The solar farm and battery project will be safe for its lifetime, taking account of the limited number of users of the Site with no increase in flood risk elsewhere.

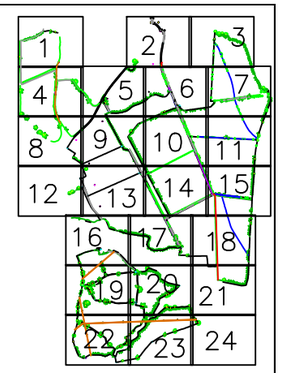
11.4.3 Additionally, the Proposed Development provides significant sustainability benefits including the significant generation of renewable electricity for the National Grid, biodiversity net gain and additional planting benefits.

APPENDICES

Appendix A

Topographic Survey







ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity ic	ra	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
ffl	floor level	tow	top of wall
fp	footpath	tp	top pipe
fl.p	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

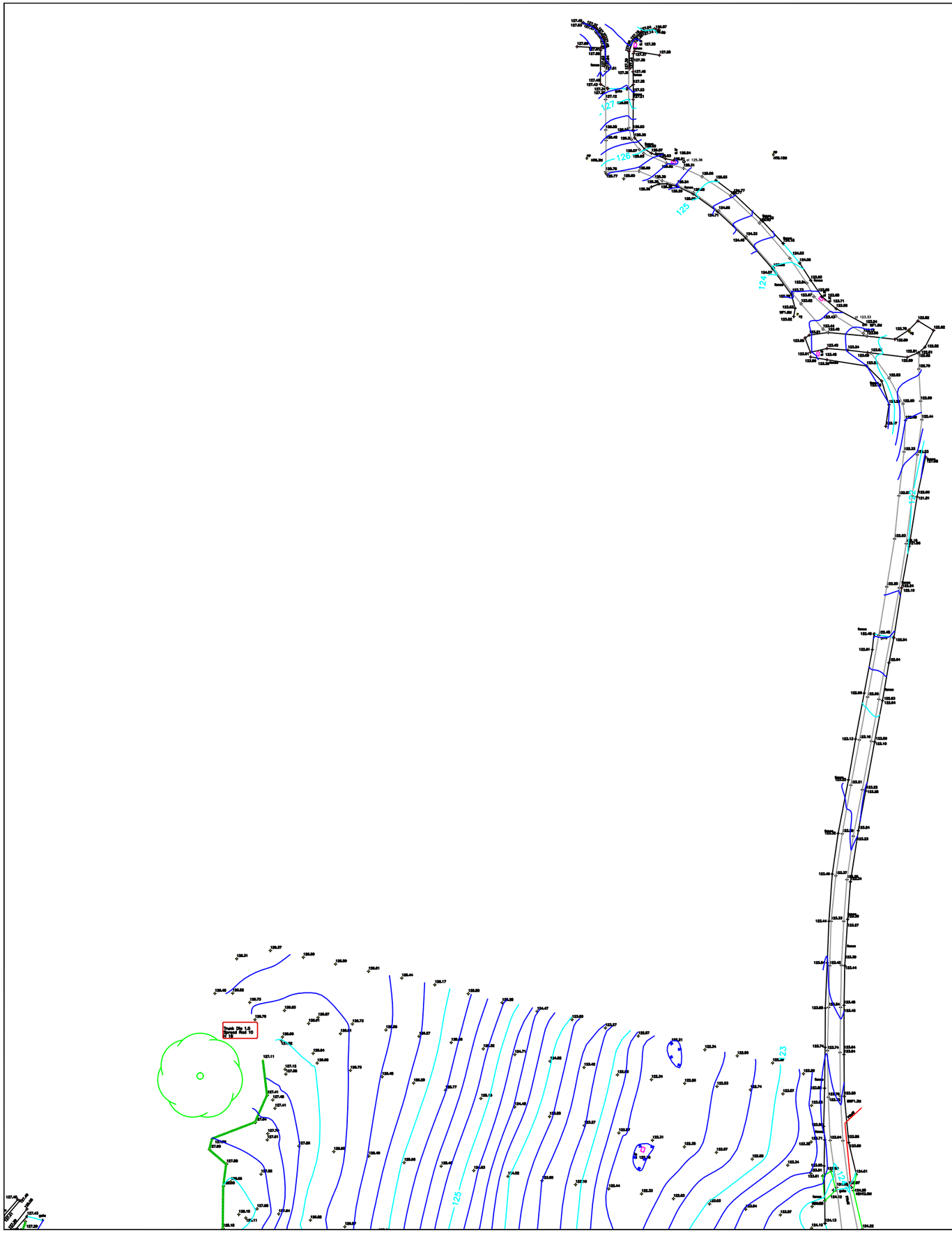
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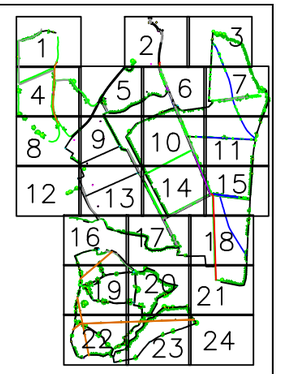
Revision No.	Description	Date	Issued By
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www.AGsurveys.co.uk

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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/1
Revision	0







ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity ic	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
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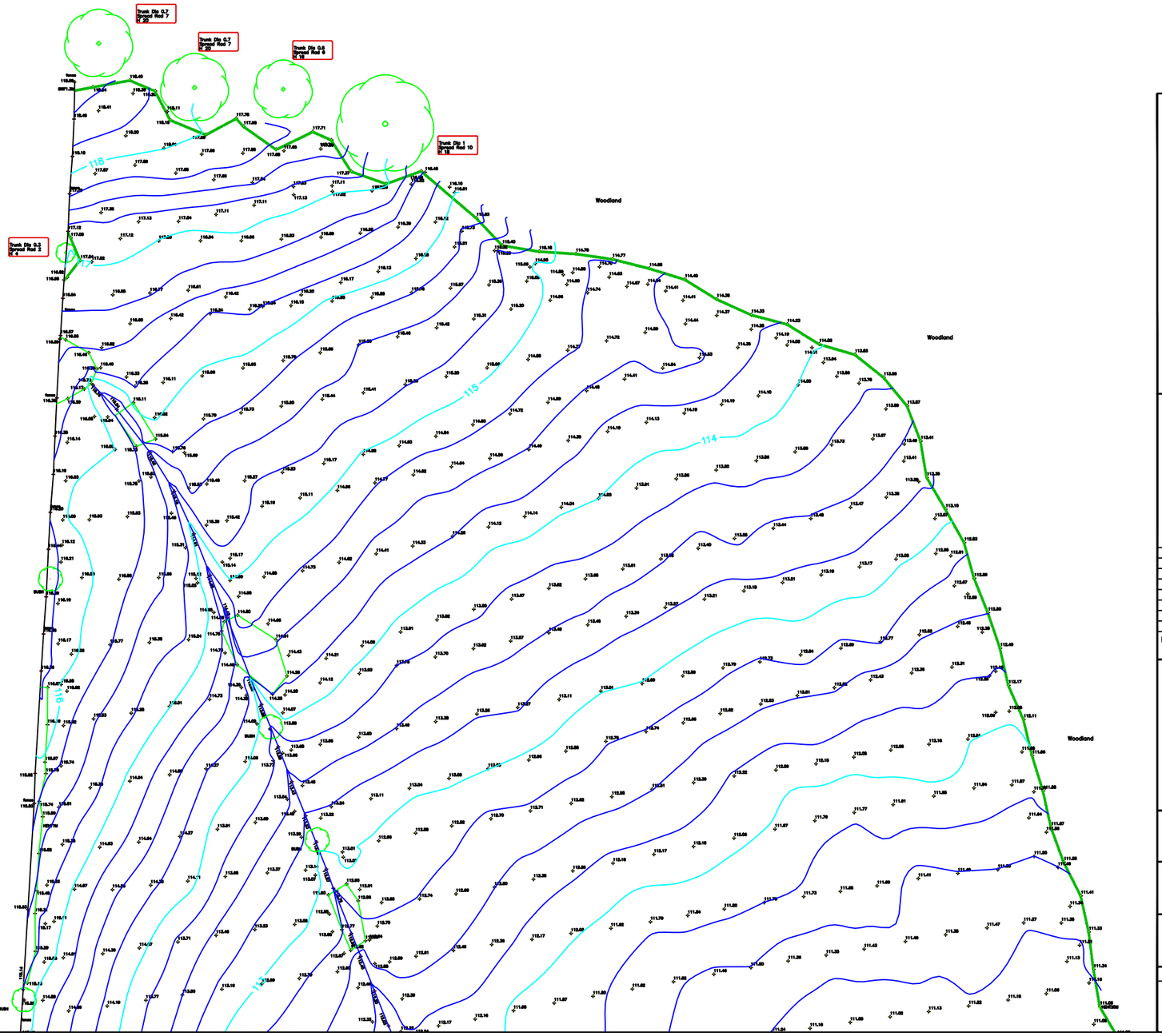
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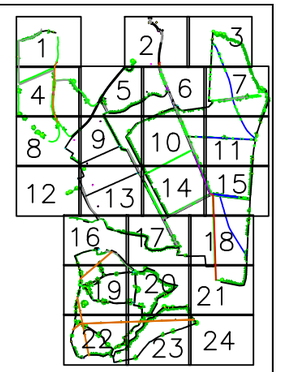
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey

Scale: 1:500 | Sheet Size A1

Drawing No. 3233/500/2 | Revision 0







ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity ic	rs	road sign
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ko	kerb outlet	DHH	door height height
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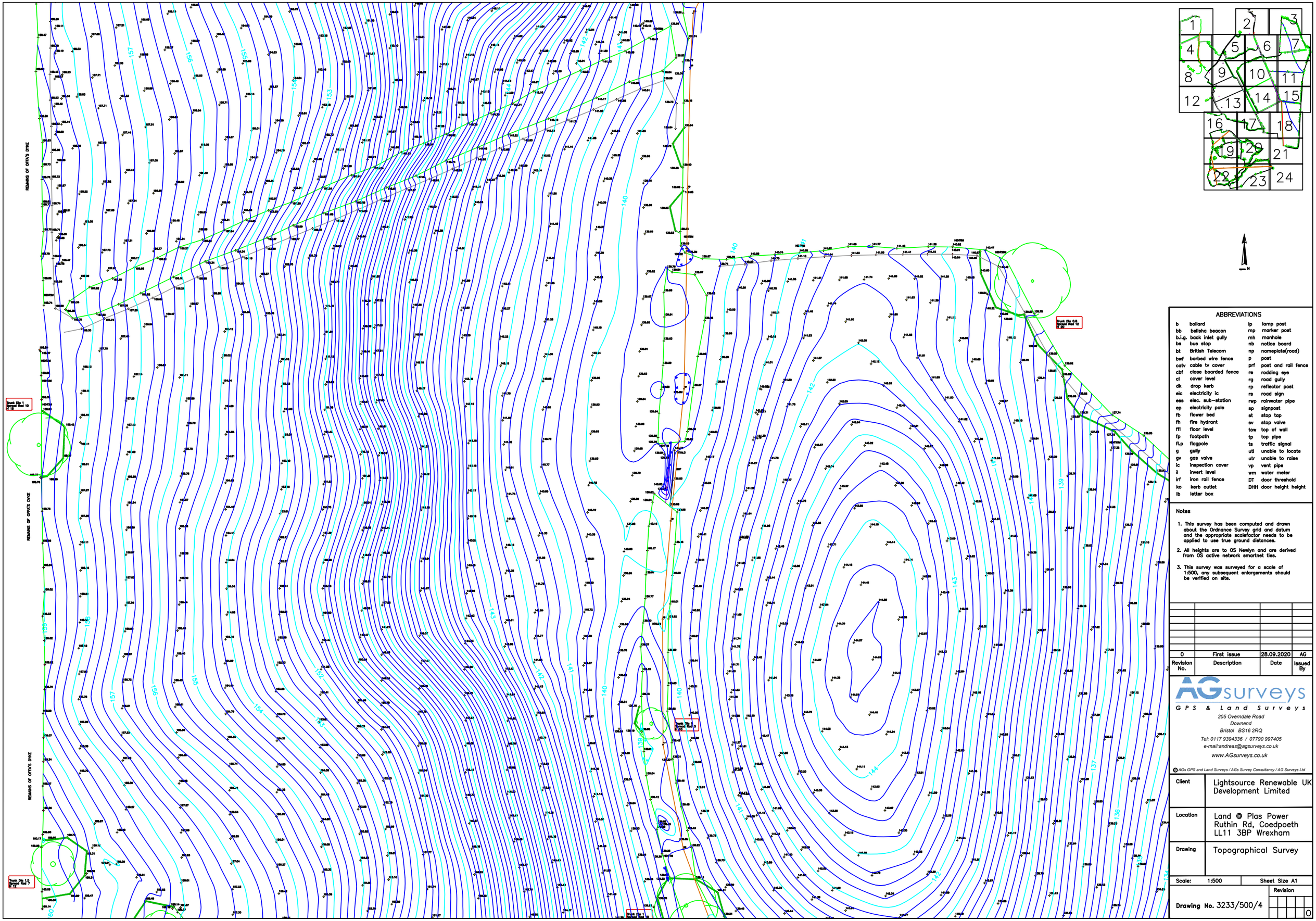
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey

Scale:	1:500	Sheet Size A1
Drawing No. 3233/500/3		Revision 0



ABBREVIATIONS

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bb	belisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
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il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

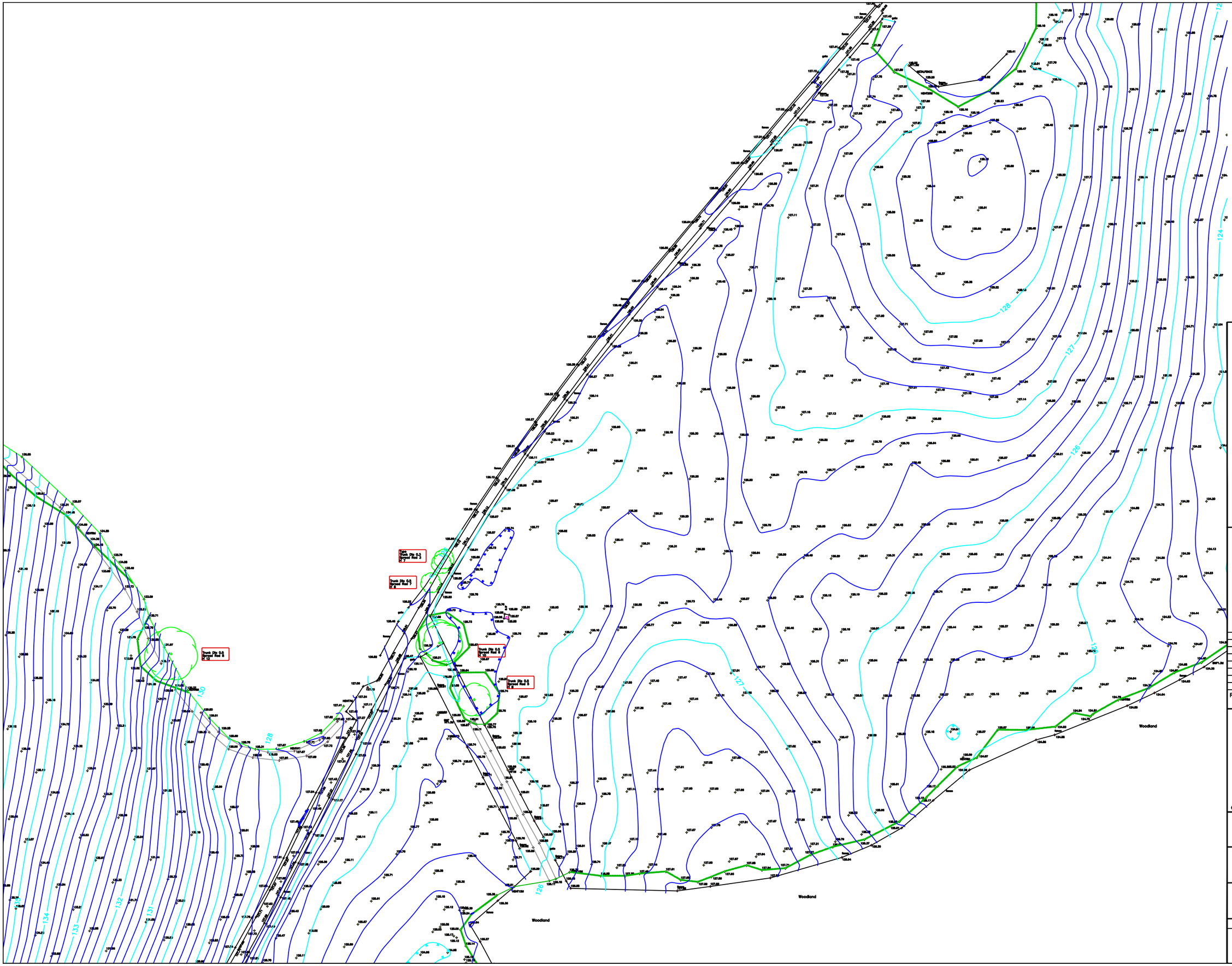
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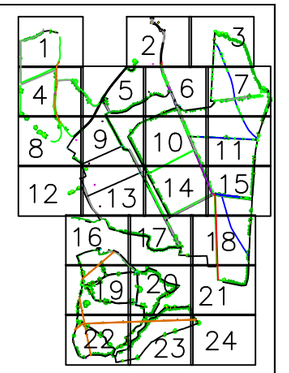
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Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/4
Revision	0





grid N

ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.l.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
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lb	letter box		

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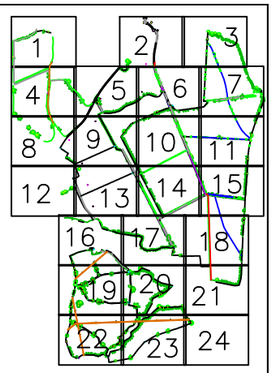
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey

Scale: 1:500	Sheet Size A1	Revision
Drawing No. 3233/500/5		0





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.l.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
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irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

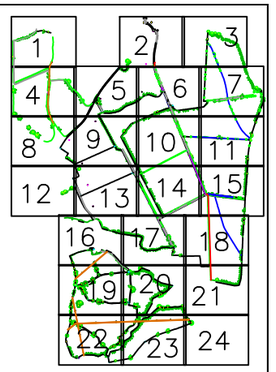
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/6
Revision	0



ABBREVIATIONS

b	bollard	lp	lamp post
bb	bellisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
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g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

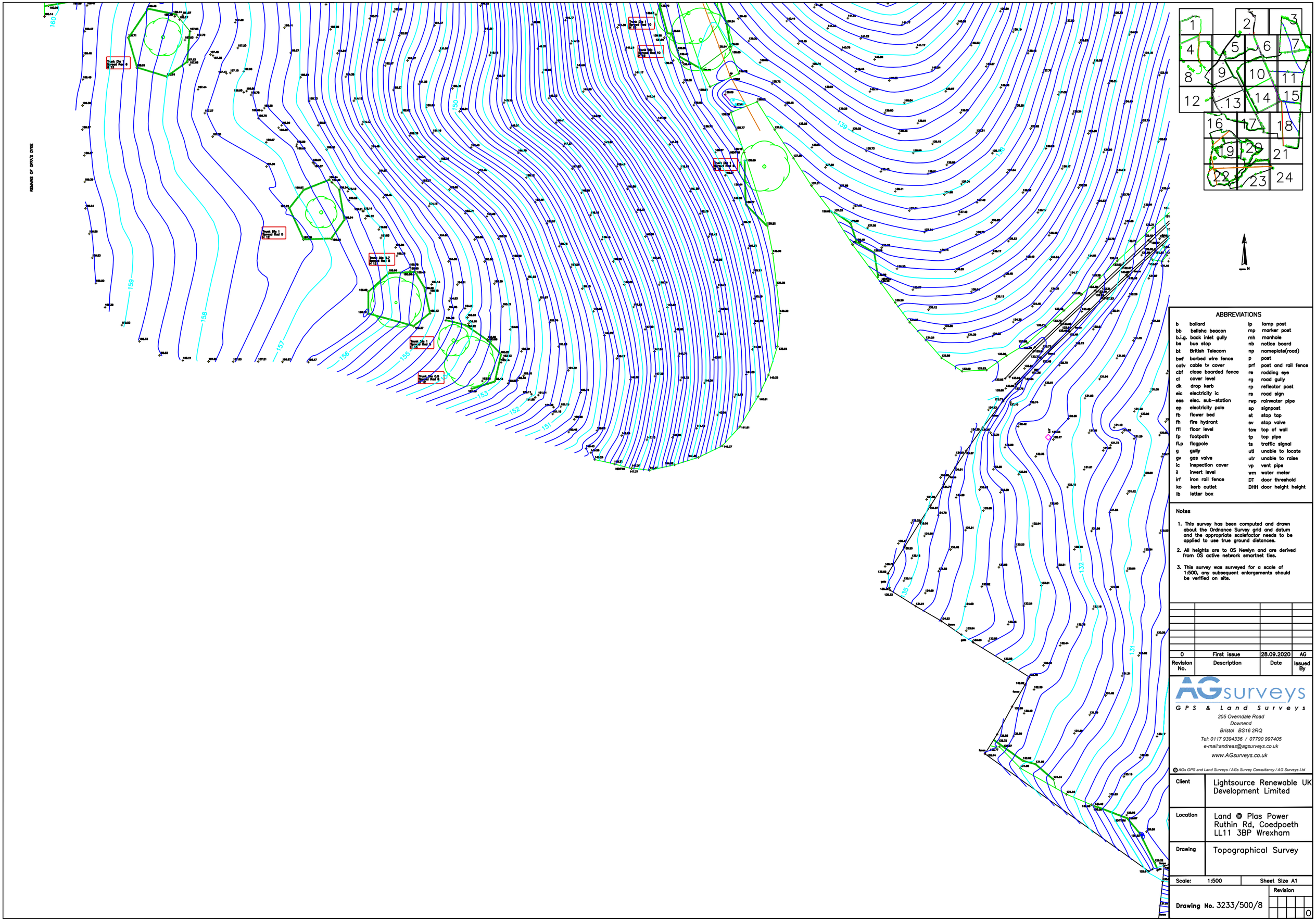
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/7
Revision	0



ABBREVIATIONS

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ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

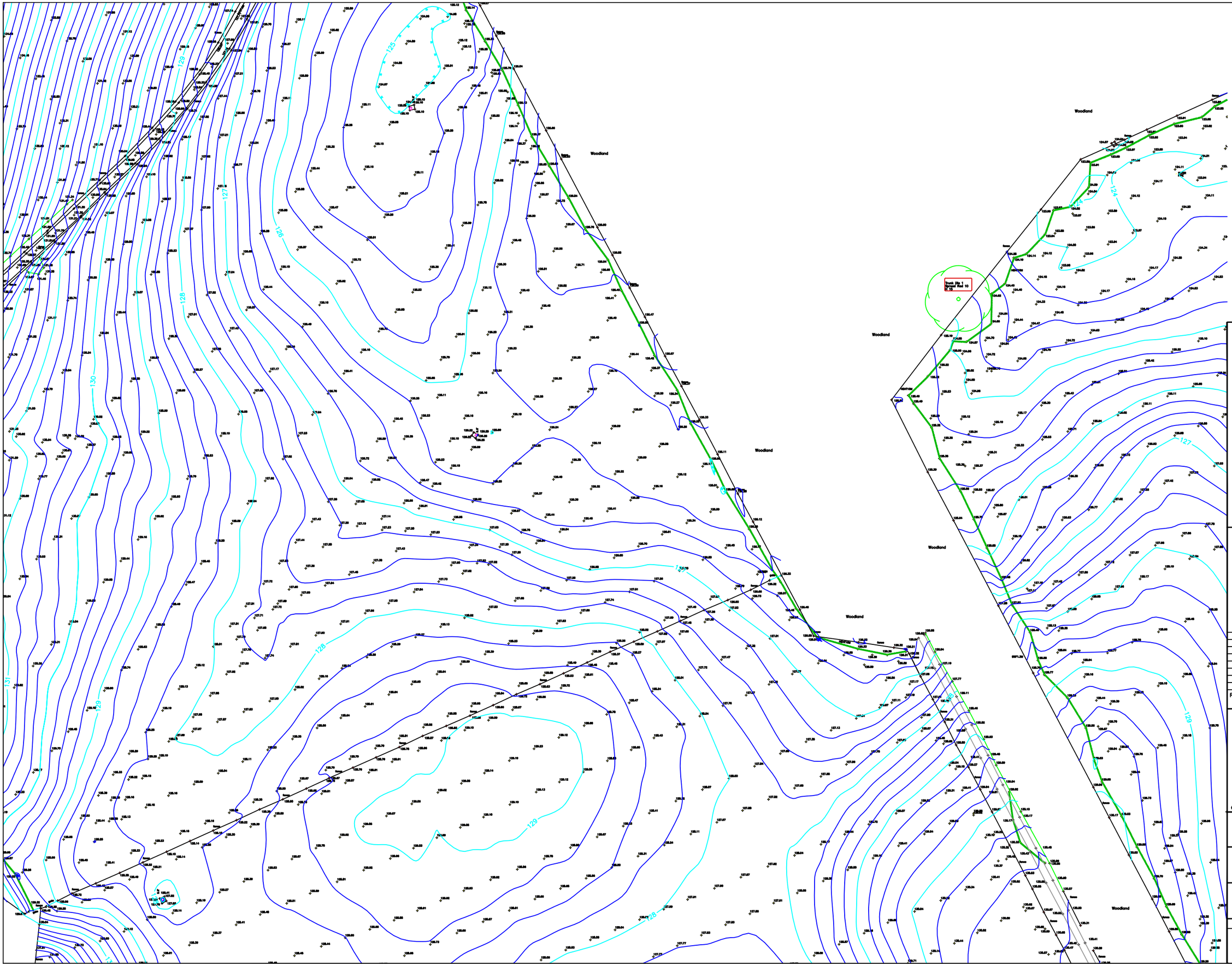
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/8
Revision	0



ABBREVIATIONS

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irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

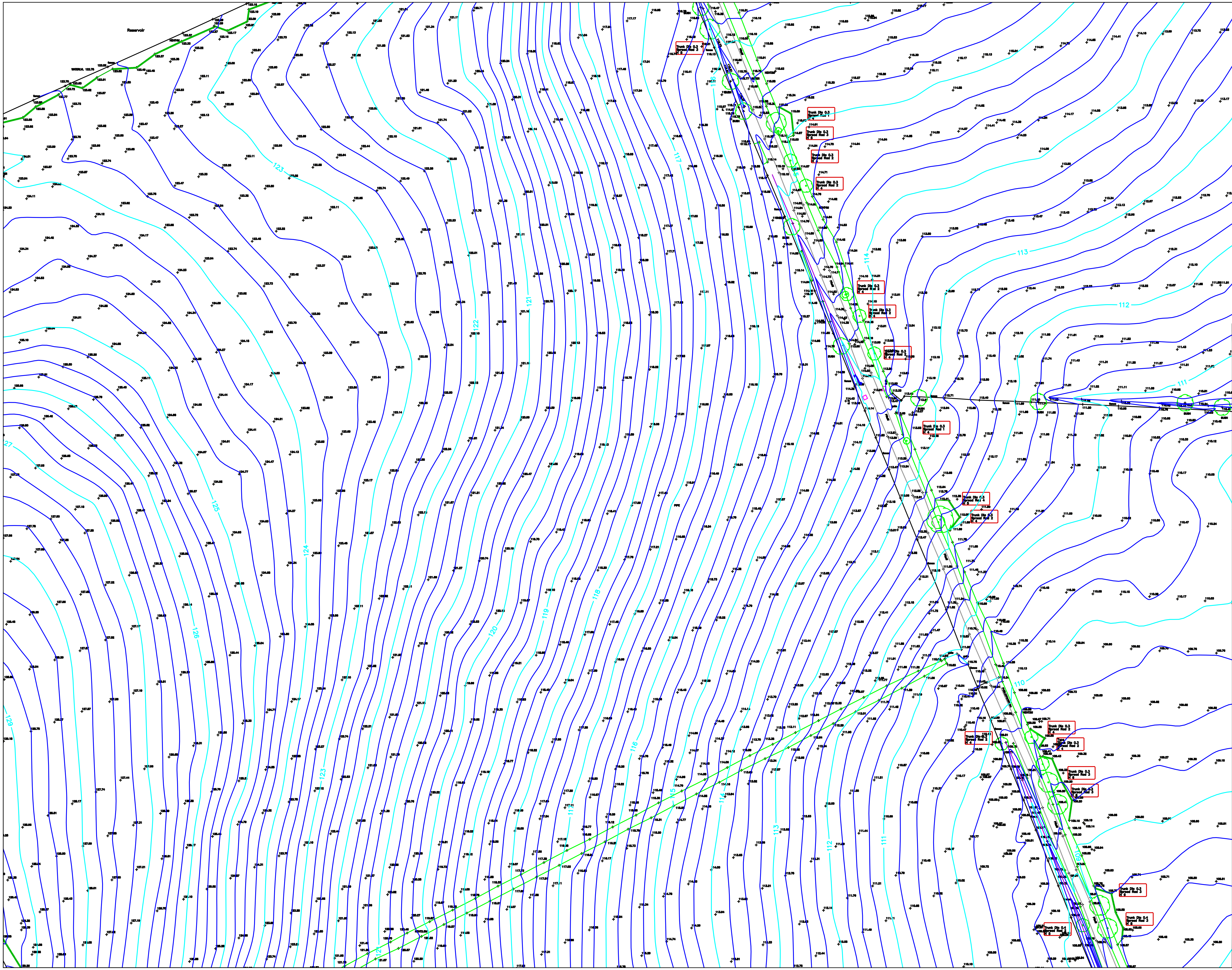
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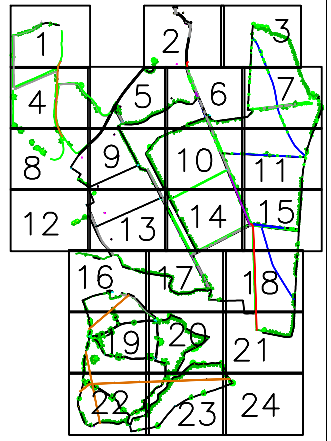
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Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/9
Revision	0





ABBREVIATIONS

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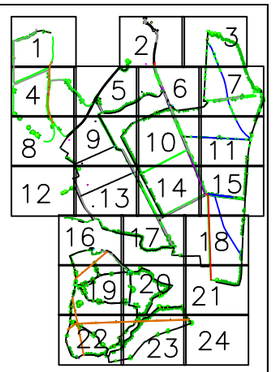
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Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale: 1:500	Sheet Size A1
Drawing No. 3233/500/10	Revision 0





ABBREVIATIONS

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ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

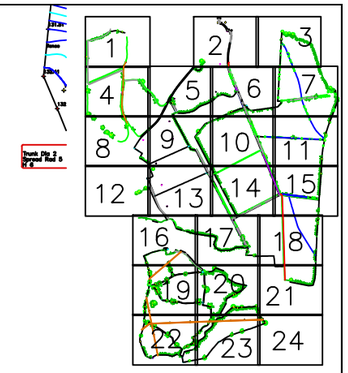
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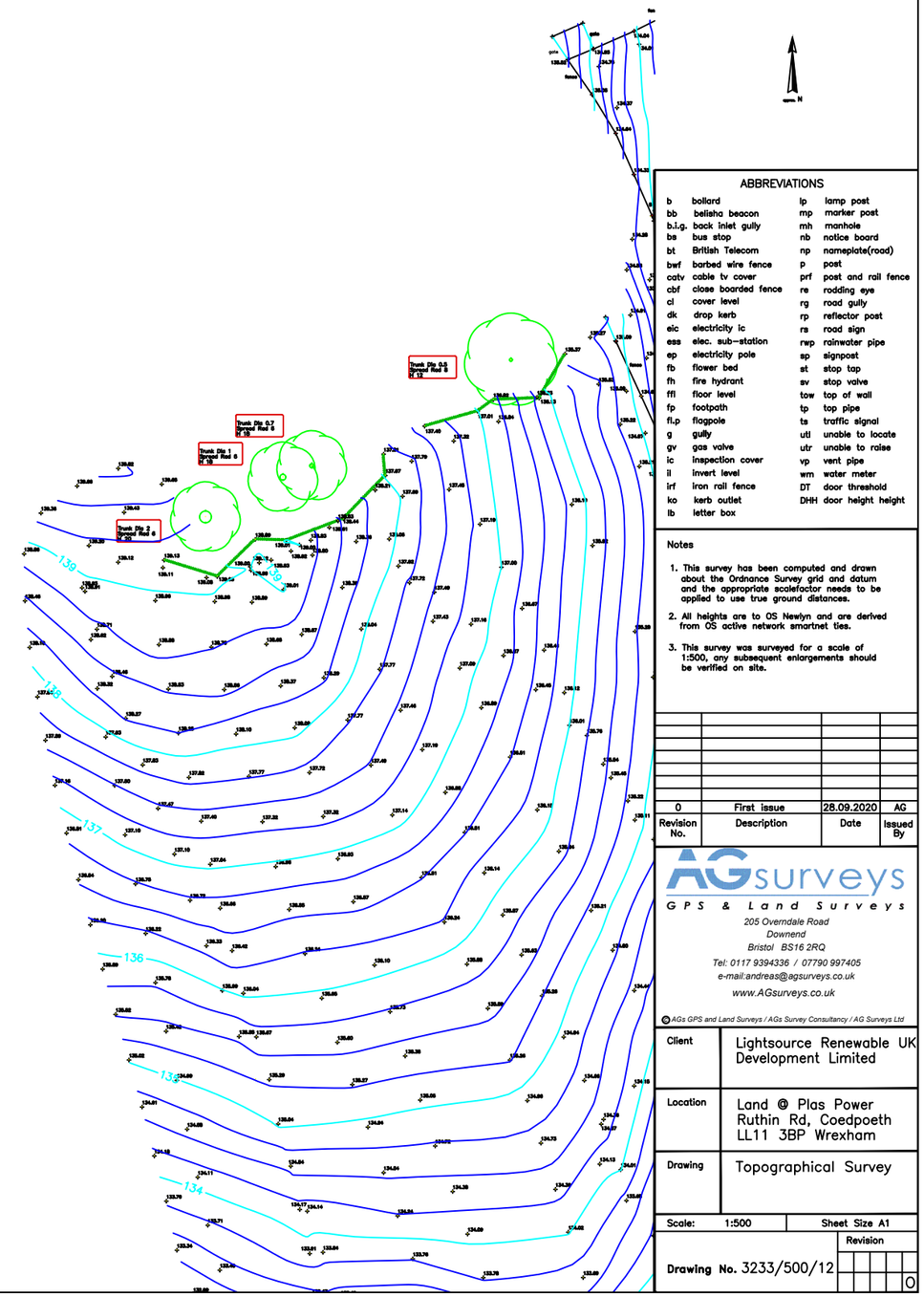
Revision No.	Description	Date	Issued By
0	First issue	28.09.2020	AG

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www.AGsurveys.co.uk

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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/11
Revision	0





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.l.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity ic	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
ffl	floor level	tow	top of wall
fp	footpath	tp	top pipe
fl.p	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

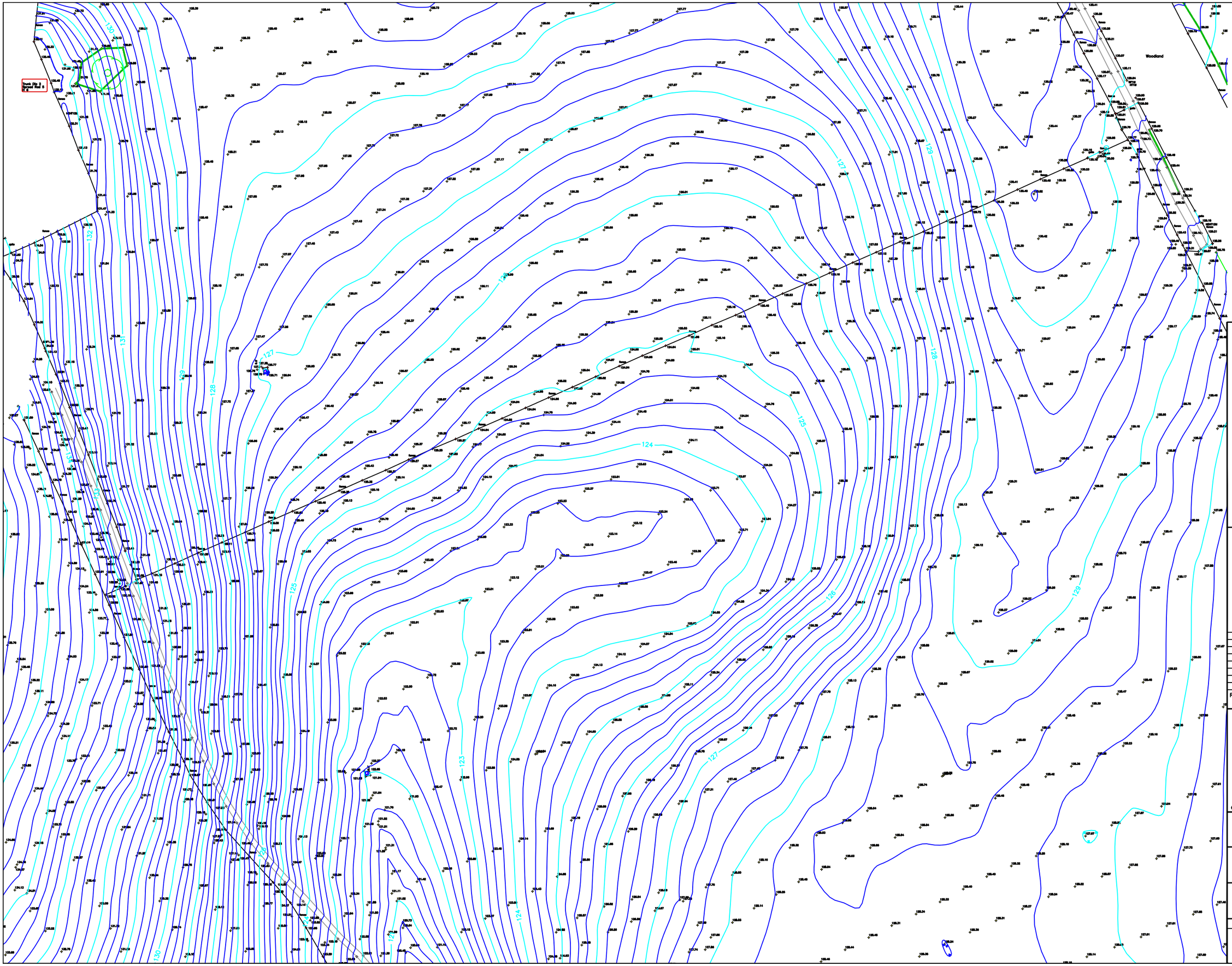
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/12
Revision	0



ABBREVIATIONS

b	bollard	lp	lamp post
bb	bellisha beacon	mp	marker post
b.l.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
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dk	drop kerb	rp	reflector post
elc	electricity ic	ra	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
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fh	fire hydrant	sv	stop valve
ffl	floor level	tow	top of wall
fp	footpath	tp	top pipe
fl.p	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

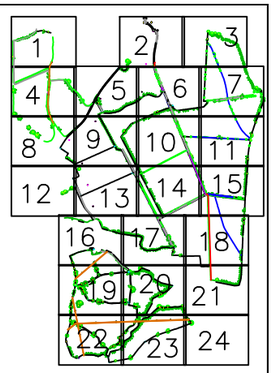
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/13
Revision	0





Woodland

Woodland

Trunk Pip 0-3
Ground Rod 3
FF 4

Trunk Pip 0-3
Ground Rod 3
FF 4

Trunk Pip 0-3
Ground Rod 3
FF 4

Trunk Pip 0-3
Ground Rod 3
FF 4

Trunk Pip 0-3
Ground Rod 3
FF 4

Trunk Pip 0-3
Ground Rod 3
FF 4

ABBREVIATIONS

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bb	bellisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
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bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
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lb	letter box		

Notes

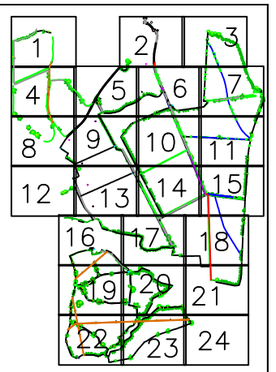
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Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/14
Revision	0



N

ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
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fh	fire hydrant	sv	stop valve
ffl	floor level	tow	top of wall
fp	footpath	tp	top pipe
fl.p	flagpole	ts	traffic signal
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ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

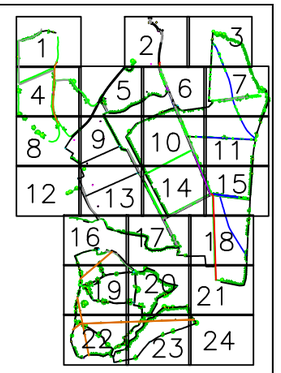
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/15
Revision	0





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
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dk	drop kerb	rp	reflector post
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fh	fire hydrant	sv	stop valve
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fp	footpath	tp	top pipe
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g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

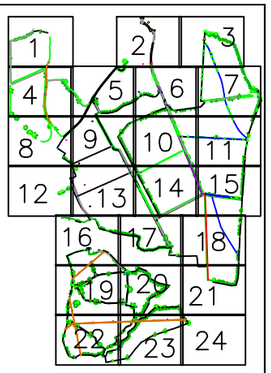
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/16
Revision	0





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
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catv	cable tv cover	prf	post and rail fence
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dk	drop kerb	rp	reflector post
elc	electricity ic	ra	road sign
ess	elec. sub-station	rwp	rainwater pipe
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fh	fire hydrant	sv	stop valve
ffl	floor level	tow	top of wall
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g	gully	utl	unable to locate
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ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

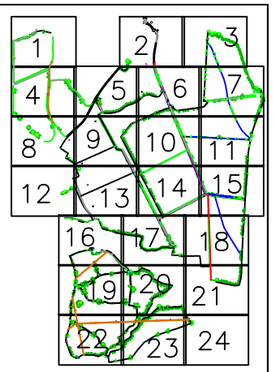
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/17
Revision	0





ABBREVIATIONS

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bb	bellisha beacon	mp	marker post
b.l.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
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ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

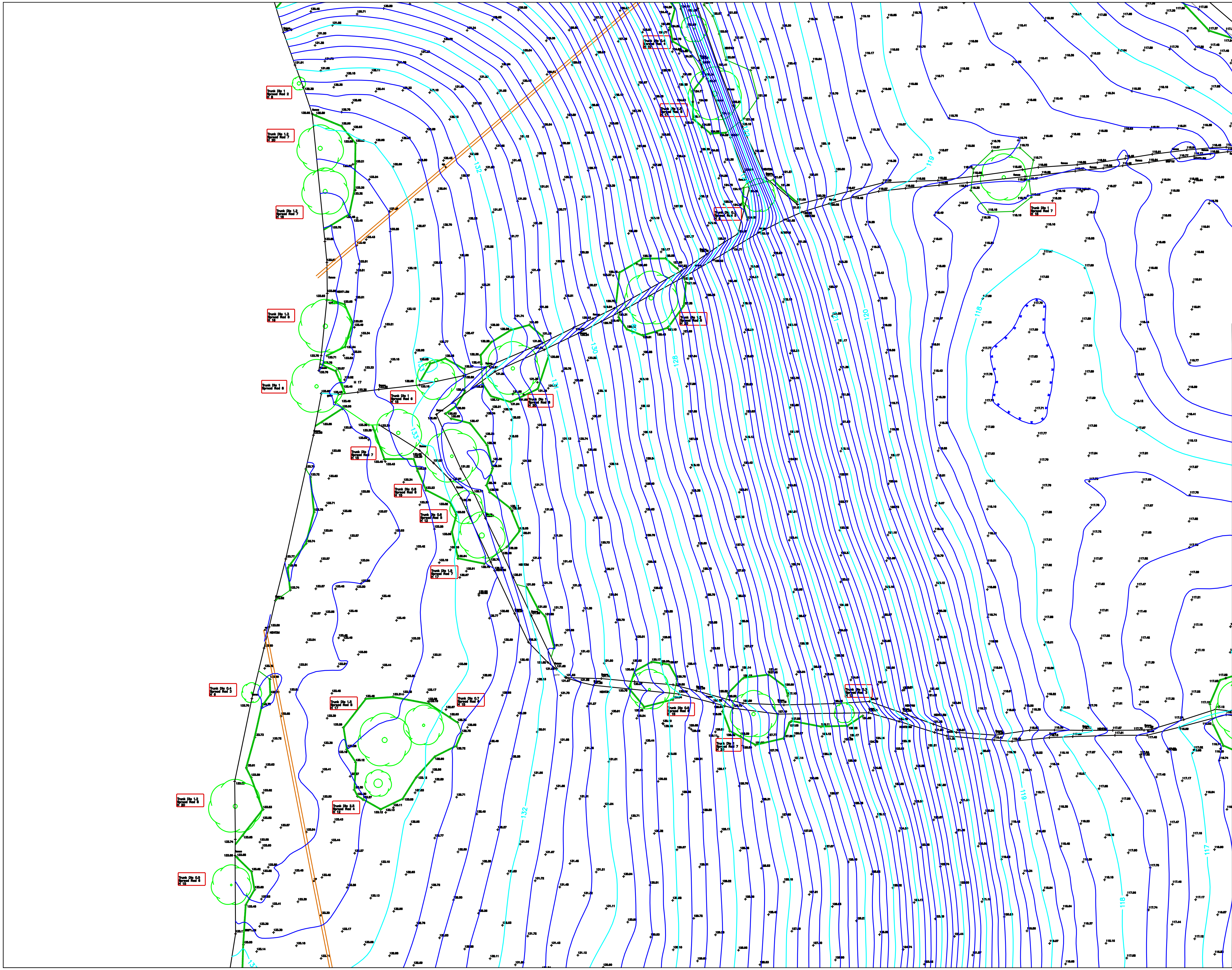
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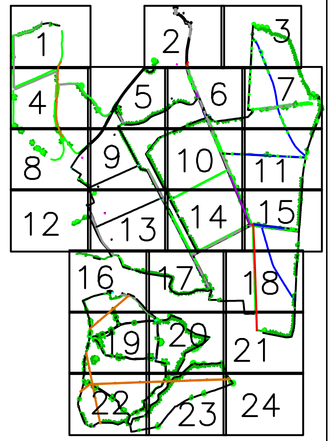
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/18
Revision	0





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
eic	electricity ic	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
ffl	floor level	tow	top of wall
fp	footpath	tp	top pipe
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il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

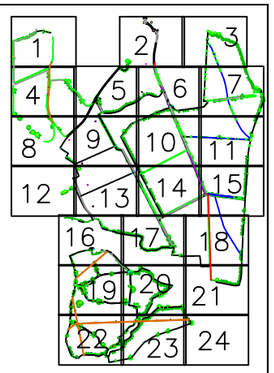
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Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale: 1:500	Sheet Size A1
Drawing No. 3233/500/19	Revision 0





ABBREVIATIONS

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bb	bellisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
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Notes

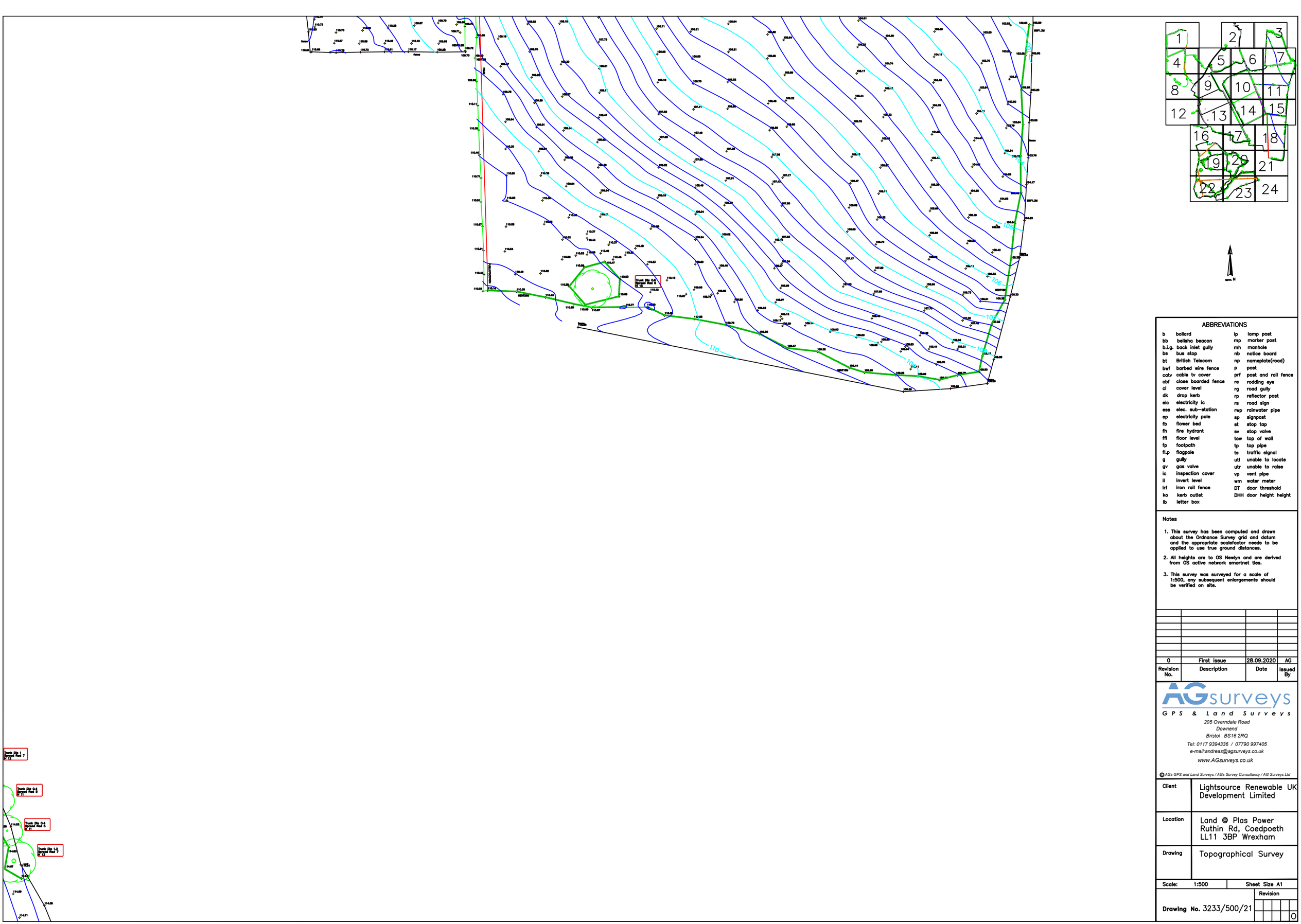
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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/20
Revision	0



ABBREVIATIONS

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b.i.g.	back inlet gully	mh	manhole
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lb	letter box		

Notes

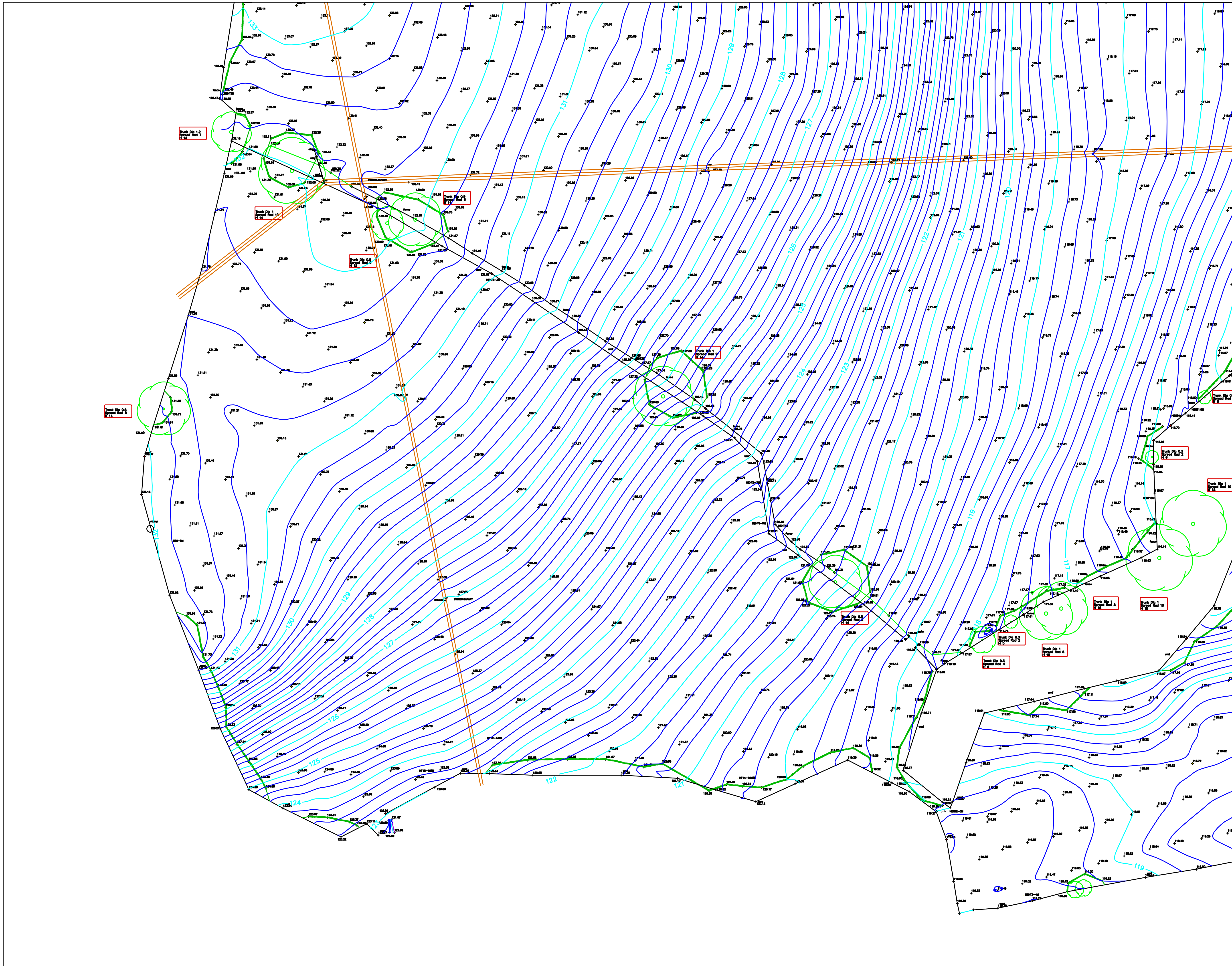
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3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

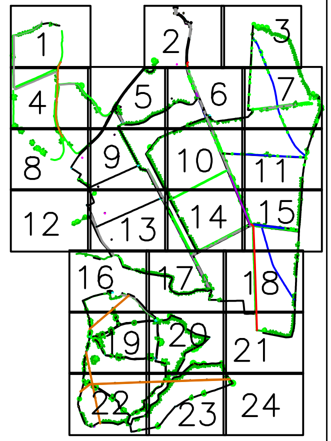
Revision No.	Description	Date	Issued By
0	First issue	28.09.2020	AG

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GPS & Land Surveys
205 Overndale Road
Downend
Bristol BS16 2RQ
Tel: 0117 9394336 / 07790 997405
e-mail:andreas@agsurveys.co.uk
www.AGsurveys.co.uk

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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale: 1:500	Sheet Size A1
Drawing No. 3233/500/21	Revision 0





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
eic	electricity ic	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
ffl	floor level	tow	top of wall
fp	footpath	tp	top pipe
fl.p	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

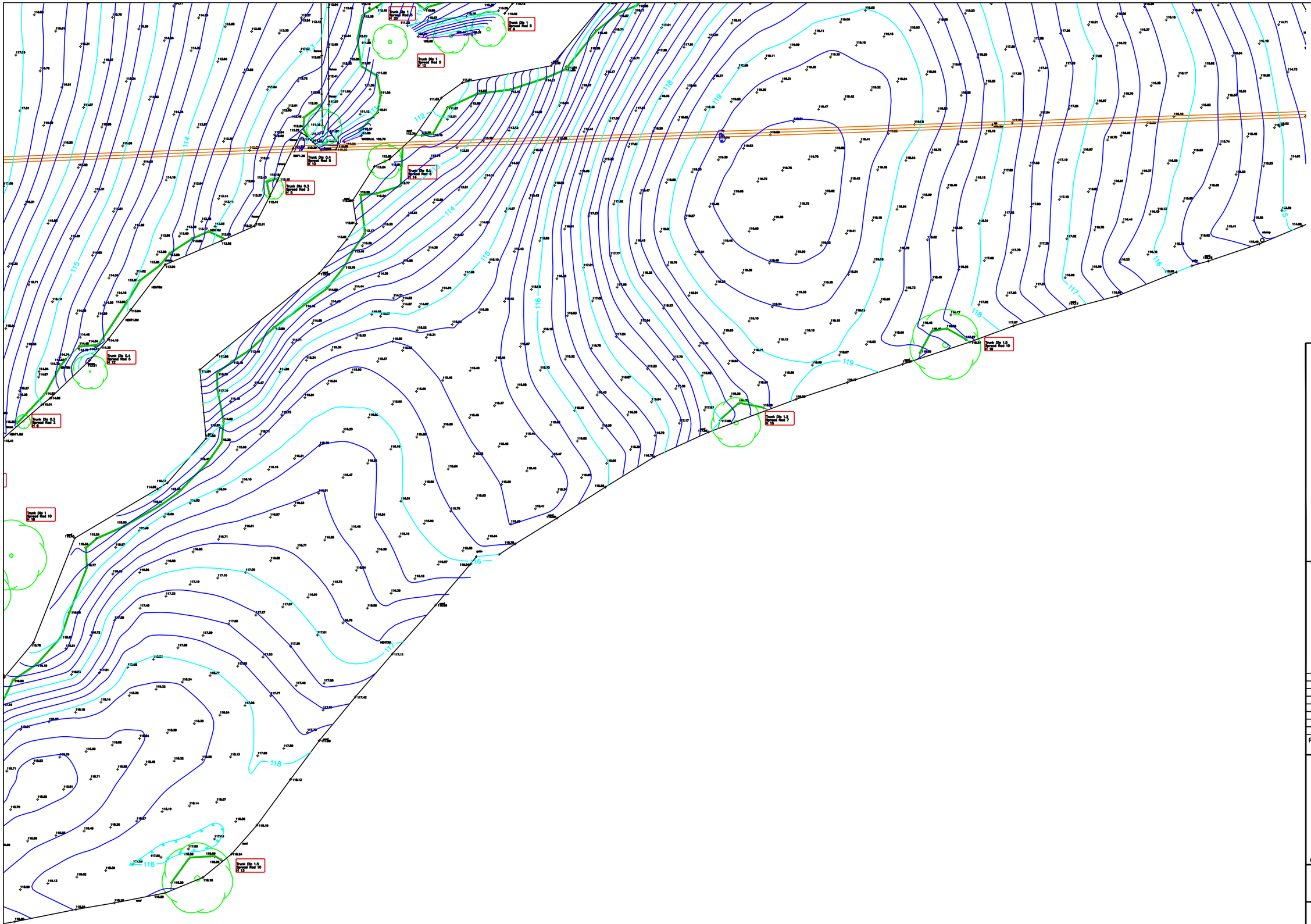
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2. All heights are to OS Newlyn and are derived from OS active network smartnet ties.
3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

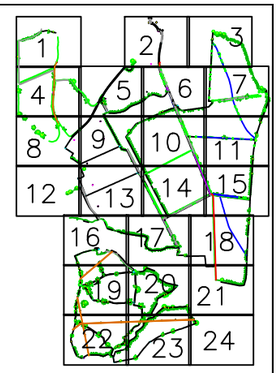
Revision No.	Description	Date	Issued By
0	First issue	28.09.2020	AG

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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale: 1:500	Sheet Size A1
Drawing No. 3233/500/22	Revision 0





ABBREVIATIONS

b	bollard	lp	lamp post
bb	bellisha beacon	mp	marker post
b.l.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity ic	ra	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
ffl	floor level	tow	top of wall
fp	footpath	tp	top pipe
fl.p	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

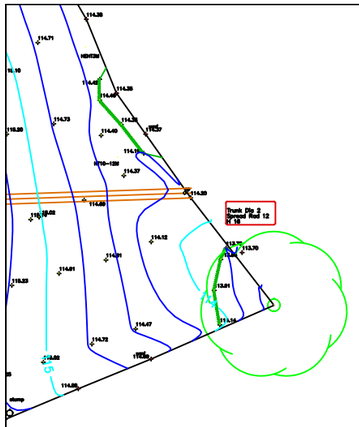
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2. All heights are to OS Newlyn and are derived from OS active network smartnet ties.
3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

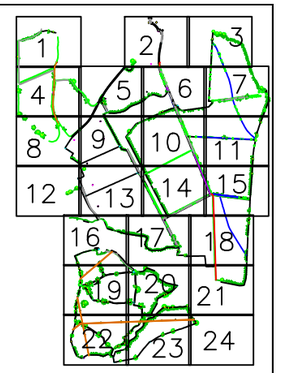
Revision No.	Description	Date	Issued By
0	First issue	28.09.2020	AG

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Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale:	1:500
Sheet Size	A1
Drawing No.	3233/500/23
Revision	0





N

ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.i.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
eic	electricity ic	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
ffl	floor level	tow	top of wall
fp	footpath	tp	top pipe
fl.p	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

1. This survey has been computed and drawn about the Ordnance Survey grid and datum and the appropriate scalefactor needs to be applied to use true ground distances.
2. All heights are to OS Newlyn and are derived from OS active network smartnet ties.
3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

Revision No.	Description	Date	Issued By
0	First issue	28.09.2020	AG

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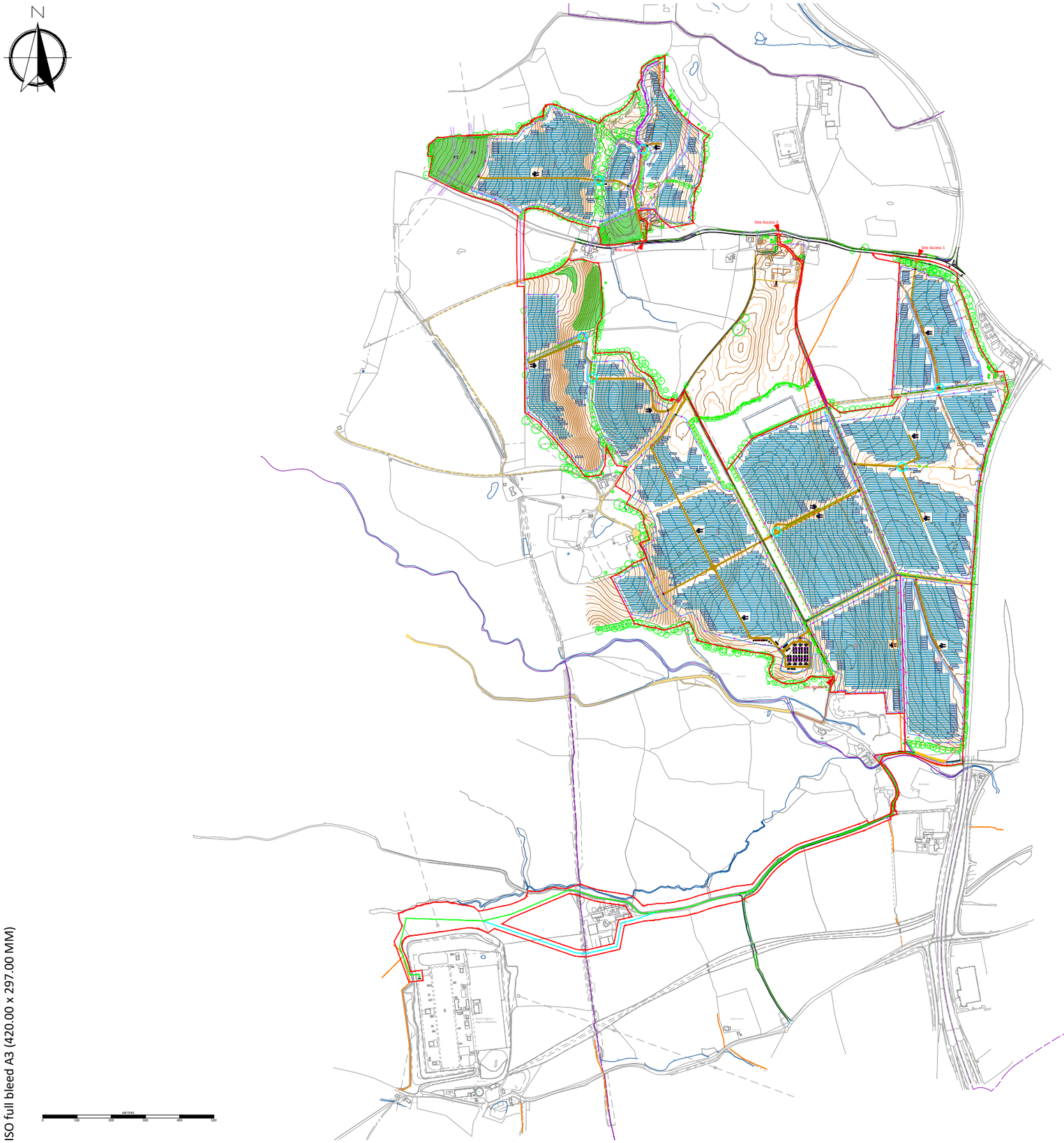
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale: 1:500	Sheet Size A1
Drawing No. 3233/500/24	Revision 0

Appendix B.1

Development Plan

GBR_Plas Power Solar & Battery Project_LP2 - Indicative Site layout_15

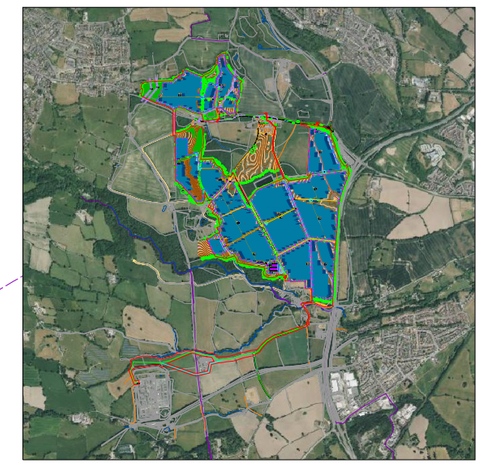
Area 1,355,959 m2 (335.06 acres)



- Site Boundary
- Site Access
- Security Fence
- Module Table 30 x 2
- Module Table 15 x 2
- Transformer
- Inverter
- Switchgear Substation
- PV Intake Substation
- GRP
- Customer Substation
- Monitoring House
- Auxiliary Transformer
- Spares Container
- Access Road
- Access Gates
- CCTV
- Toilet
- BESS Enclosure x 4
- BIC
- Twin MV Skid
- Backup Generator
- BESS Intake Substation
- Spares Container
- BESS Security Fence
- Landscape / Biodiversity
- Preferred Cable Route Option
- Cable Route Option 1
- Cable Route Option 2
- Cable Route Option 3
- Cable Route
- Existing PRoW
- Proposed PRoW diversion
- Possible hedge removal
- Indicative Swales
- Attenuation Pond
- Existing Access Road
- Existing Tree
- Existing Hedgerow/Vegetation
- Existing Ditch
- Cable Sealing End

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Scale 1:50000



DA			22.05.2024
DRAWN	CHECKED	APPROVED	DATE

PROJECT NAME & ADDRESS:
Location: Plas Power Estate, Rhosrobin
Postcode: Caego, Wrexham, Wales

NOTES:
-
-
-
-

Paper Size:	Scale:	Sheet:
A3	1:12500	1

CAPACITY:

DRAWING TITLE:
GBR_Plas Power Solar & Battery Project_LP2 - Indicative Site Layout_15

DRAWING NUMBER:	STATUS:
LP2-PDL	

lightsource bp
bp
Lightsource Renewable Development Limited,
7th Floor, 33 Holborn, London, EC1N 2HU
General: +44 (0) 333 200 0755
Web: www.lightsourcebp.com
info@lightsourcebp.com

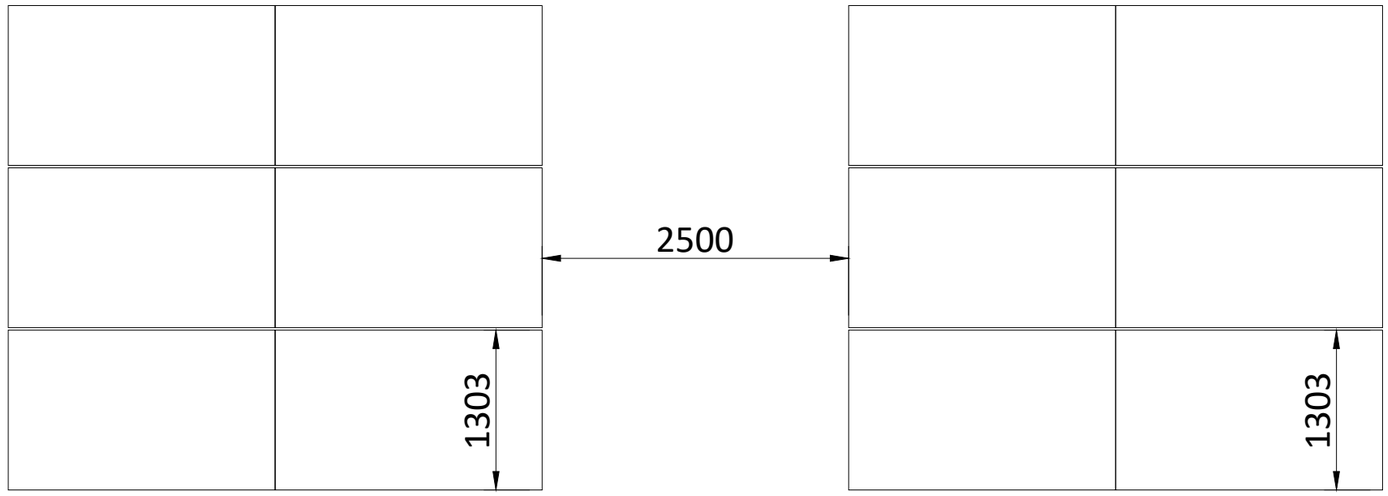
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ISO full bleed A3 (420.00 x 297.00 MM)

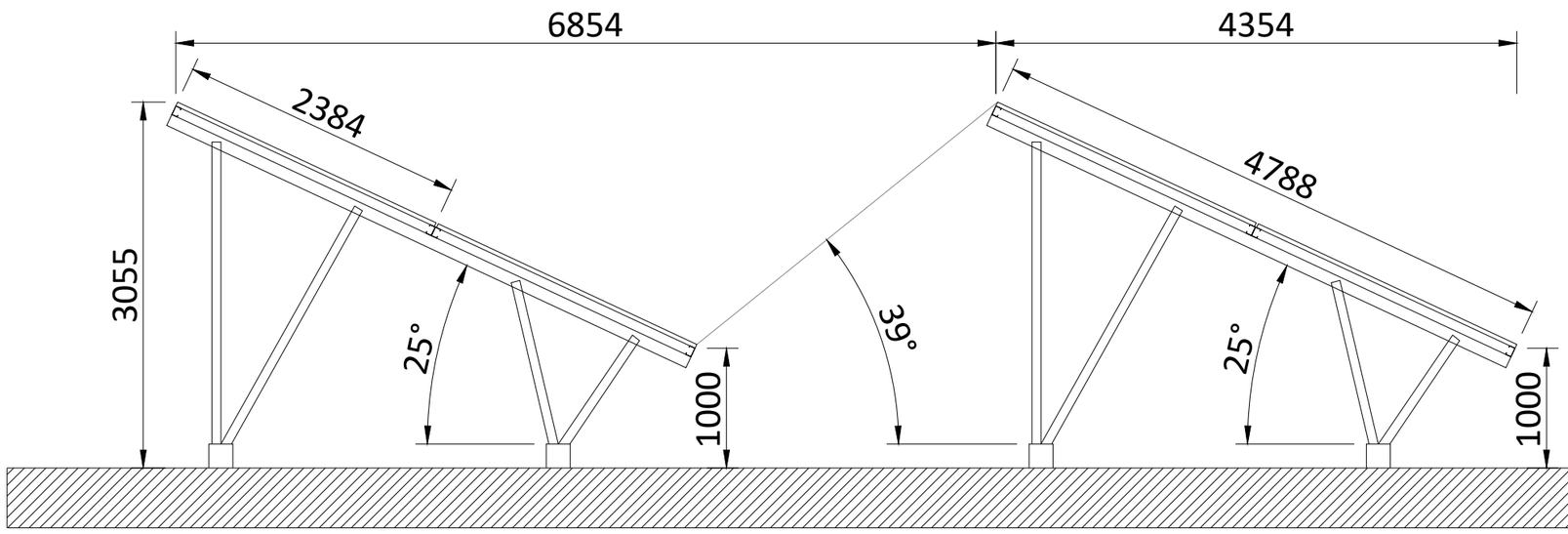
Appendix B.2

Solar Panels

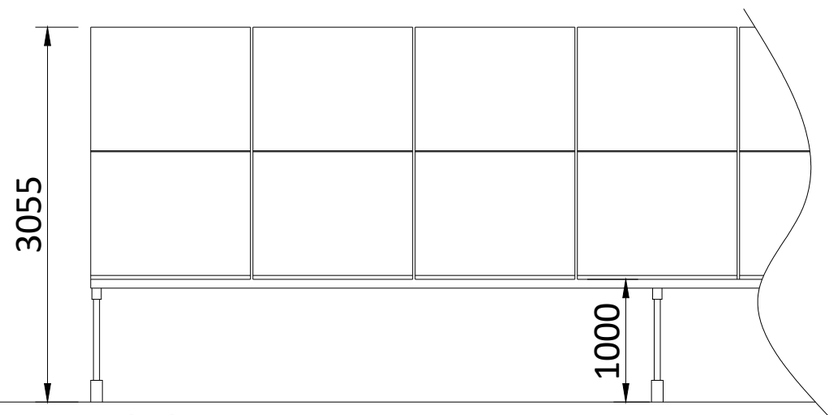
Panel Elevation 2 Portrait 25/6854



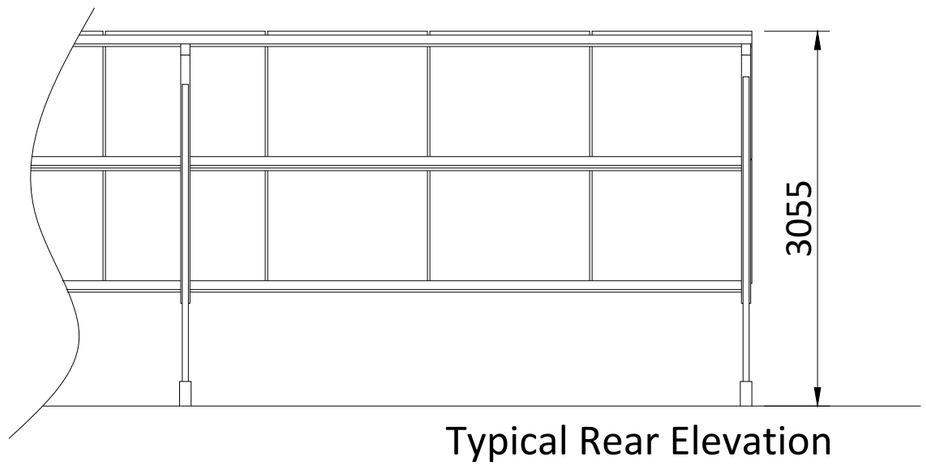
Plan



Typical Section



Typical Elevation



Typical Rear Elevation

METERS

0 1 2 3 4 5

A3 - (420 x 297)mm

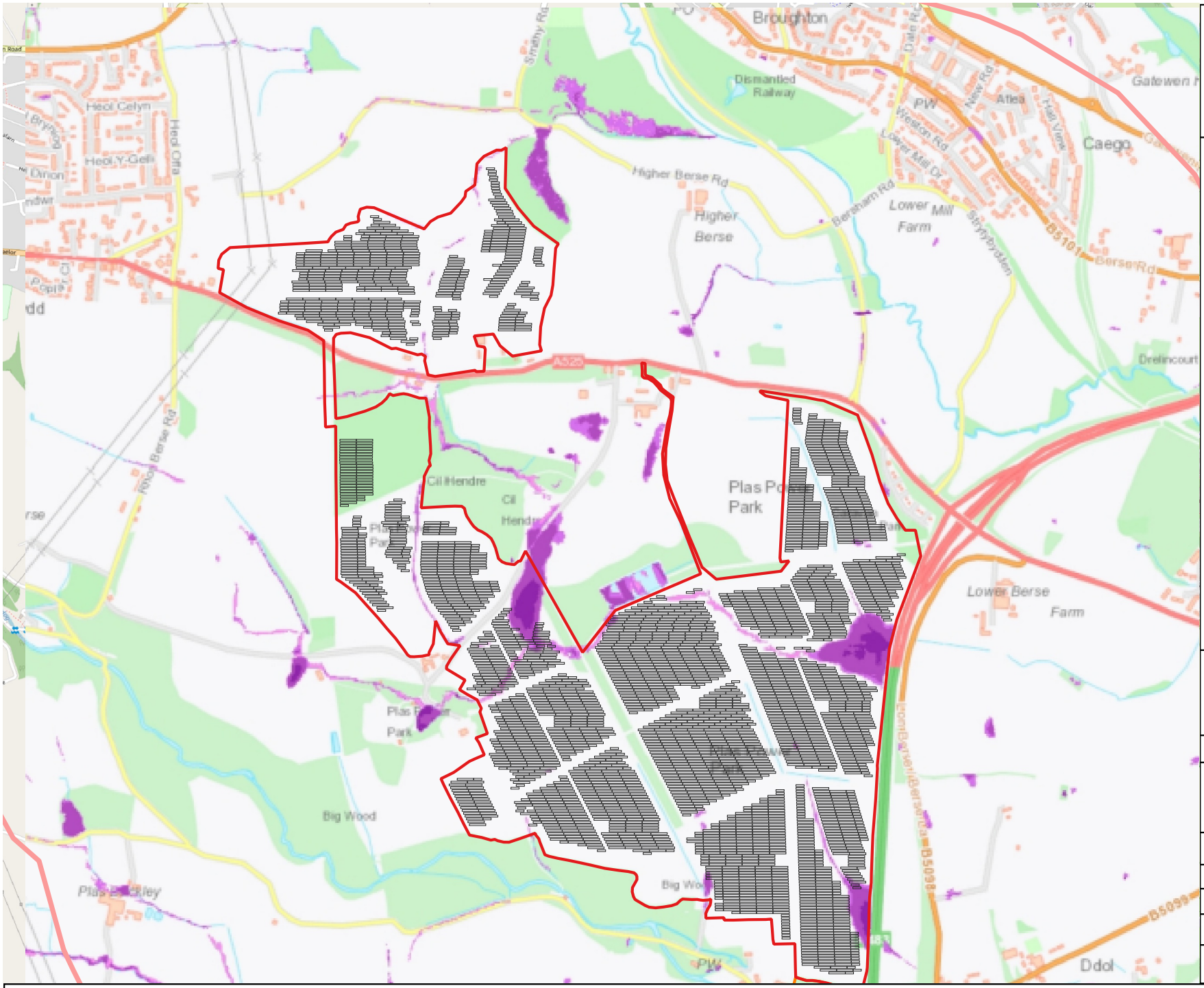
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Panel Elevation 2 Portrait 25/6854			
DA			12.01.2022
DRAWN	CHECKED	APPROVED	DATE
Paper Size: A3	Scale: 1:50	Sheet: 1	
DRAWING NUMBER: PNL_2P_25/6854	STATUS: Preliminary		

Lightsource Renewable Development Limited,
7th Floor, 33 Holborn, London, EC1N 2HU
General: +44 (0) 333 200 0755
Web: www.lightsourcebp.com
info@lightsourcebp.com

Appendix C

NRW Flood Maps



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2. If received electronically it is the recipients responsibility to print to the correct scale. Only written dimensions should be used.

Legend

- Site Plan
- Less than 0.15m
- 0.15 - 0.30m
- 0.30 - 0.90m
- Greater than 0.9m

rps
A TETRA TECH COMPANY
20 Farringdon Street
London, EC4A 4AB
E:rpshydrologyservices@rpsgroup.com

Client: Lightsource BP

Title: Proposed Development and High Risk Flood Depths

Site: Plas Power

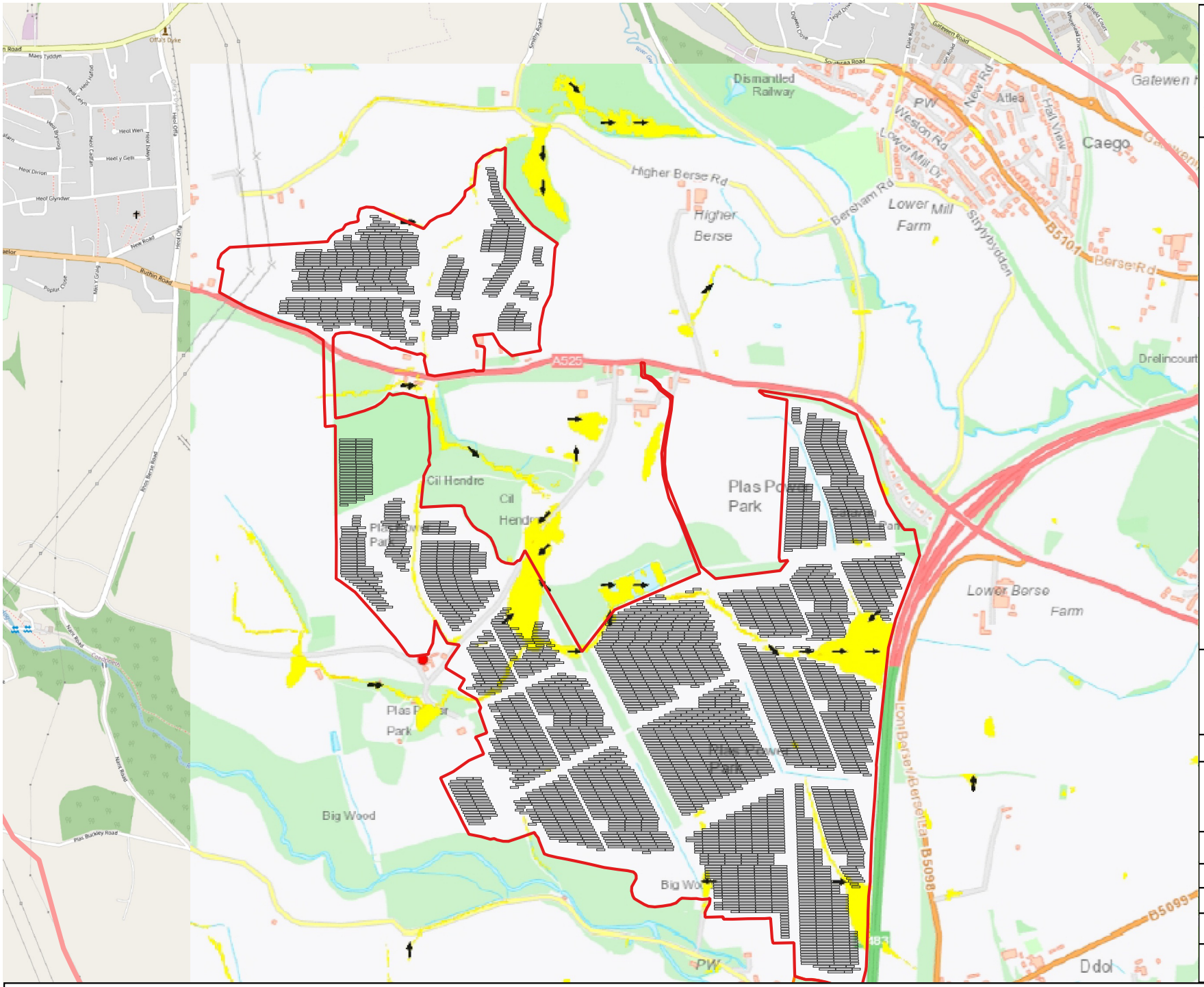
Date: 07-02-2024

Scale:1:12,500	Size: A3
Job Ref: HLEF85062	Rev: 2

Drawn	Checked	Approved
TJ	JM	JM

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Legend

- Site Plan
- Flow Direction
- Less than 1m/s
- 1 - 2m/s
- 2 - 3m/s
- Greater than 3m/s

20 Farringdon Street
London, EC4A 4AB
E:rpshydrologyservices@rpsgroup.com

Client: Lightsource BP

Title: Proposed Development and High Risk Velocity

Site: Plas Power

Date: 07-02-2024

Scale:1:12,500	Size: A3
Job Ref: HLEF85062	Rev: 2

Drawn	Checked	Approved
TJ	JM	JM

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0 0.25 0.5 0.75 1 km

N

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Appendix D

Greenfield Runoff Rate (MicroDrainage)

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	1.000	Urban	0.000
SAAR (mm)	967	Region Number	Region 9

Results l/s

QBAR Rural	2.7
QBAR Urban	2.7
Q100 years	5.8
Q1 year	2.3
Q30 years	4.7
Q100 years	5.8

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Appendix E

Conceptual Drainage Plan



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2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.
3. This drawing should be read in conjunction with all other relevant drawings and specifications.

PRELIMINARY
SUBJECT TO DETAILED DESIGN

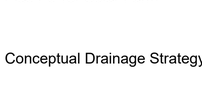
This drawing illustrates a sketch proposal only and as such is subject to detailed site investigation including ground conditions/contaminants, drainage, design and planning/density negotiations. The layout maybe based upon an enlargement of an OS sheet or other small scale plans and its accuracy will need to be verified by Survey. Full risk analysis under the CDM Regulations has not been undertaken.

KEY

Surface Water Pipe Line

Surface Water Headwall

Cross Section - Swale



30cm deep, 1 in 3 slope

5	Incorporation of fire water storage	TJ	JM	16.05.24
4	Updated in line with new plan	TJ	JM	02.02.24
3	Updated in line with new plan	TJ	JM	25.10.23
2	Updated to include BESS	AM	JM	02.10.23
1	Conceptual Drainage Strategy	TJ	JM	19.09.23

A TETRA TECH COMPANY

20 Farringdon Street, London, EC4A 4AB
T: +44 20 3691 0500 E: rpshydrologyservices@rpsgroup.com

Client: Lightsource BP

Project: Plas Power Solar Farm

Title: Conceptual Drainage Strategy

Status	Scale	Date Created
FINAL	1:1 @A1	19.09.2023

Task Team Manager	Information Author	Task Information Manager
JM	TJ	JM

Document Number: HLEF85062-RPS-Plas Power_CD-DR-2-01022024

RPS Project Number: HLEF 85062

Revision: 5

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Q:\Environment\01 Projects\HLEF - Flood\HLEF 85062 - Plas Power ES\7. CAD\AM HLEF 85062 Plas Power_Conceptual Drainage_D_v0.5 TJ.dwg

Appendix F

Attenuation Features (MicroDrainage)

Summary of Results for 100 year Return Period (+20%)

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.718	0.018	0.0	0.4	Flood Risk
30 min Summer	9.725	0.025	0.0	0.5	Flood Risk
60 min Summer	9.733	0.033	0.0	0.7	Flood Risk
120 min Summer	9.742	0.042	0.0	0.8	Flood Risk
180 min Summer	9.747	0.047	0.0	0.9	Flood Risk
240 min Summer	9.751	0.051	0.0	1.0	Flood Risk
360 min Summer	9.757	0.057	0.0	1.2	Flood Risk
480 min Summer	9.762	0.062	0.0	1.2	Flood Risk
600 min Summer	9.766	0.066	0.0	1.3	Flood Risk
720 min Summer	9.769	0.069	0.0	1.4	Flood Risk
960 min Summer	9.775	0.075	0.0	1.5	Flood Risk
1440 min Summer	9.783	0.083	0.0	1.7	Flood Risk
2160 min Summer	9.792	0.092	0.0	1.8	Flood Risk
2880 min Summer	9.798	0.098	0.0	2.0	Flood Risk
4320 min Summer	9.808	0.108	0.0	2.2	Flood Risk
5760 min Summer	9.816	0.116	0.0	2.3	Flood Risk
7200 min Summer	9.822	0.122	0.0	2.5	Flood Risk
8640 min Summer	9.828	0.128	0.0	2.6	Flood Risk
10080 min Summer	9.833	0.133	0.0	2.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	95.156	0.0	27
30 min Summer	65.779	0.0	42
60 min Summer	43.553	0.0	72
120 min Summer	27.859	0.0	132
180 min Summer	21.105	0.0	192
240 min Summer	17.183	0.0	252
360 min Summer	12.816	0.0	372
480 min Summer	10.402	0.0	492
600 min Summer	8.838	0.0	612
720 min Summer	7.732	0.0	732
960 min Summer	6.253	0.0	972
1440 min Summer	4.625	0.0	1452
2160 min Summer	3.411	0.0	2172
2880 min Summer	2.744	0.0	2892
4320 min Summer	2.014	0.0	4332
5760 min Summer	1.618	0.0	5776
7200 min Summer	1.366	0.0	7216
8640 min Summer	1.190	0.0	8656
10080 min Summer	1.059	0.0	10096

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Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	9.720	0.020	0.0	0.4	Flood Risk
30 min Winter	9.727	0.027	0.0	0.6	Flood Risk
60 min Winter	9.736	0.036	0.0	0.7	Flood Risk
120 min Winter	9.747	0.047	0.0	0.9	Flood Risk
180 min Winter	9.753	0.053	0.0	1.1	Flood Risk
240 min Winter	9.757	0.057	0.0	1.2	Flood Risk
360 min Winter	9.764	0.064	0.0	1.3	Flood Risk
480 min Winter	9.770	0.070	0.0	1.4	Flood Risk
600 min Winter	9.774	0.074	0.0	1.5	Flood Risk
720 min Winter	9.778	0.078	0.0	1.6	Flood Risk
960 min Winter	9.784	0.084	0.0	1.7	Flood Risk
1440 min Winter	9.793	0.093	0.0	1.9	Flood Risk
2160 min Winter	9.803	0.103	0.0	2.1	Flood Risk
2880 min Winter	9.810	0.110	0.0	2.2	Flood Risk
4320 min Winter	9.821	0.121	0.0	2.4	Flood Risk
5760 min Winter	9.830	0.130	0.0	2.6	Flood Risk
7200 min Winter	9.837	0.137	0.0	2.8	Flood Risk
8640 min Winter	9.843	0.143	0.0	2.9	Flood Risk
10080 min Winter	9.849	0.149	0.0	3.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	95.156	0.0	27
30 min Winter	65.779	0.0	42
60 min Winter	43.553	0.0	72
120 min Winter	27.859	0.0	132
180 min Winter	21.105	0.0	192
240 min Winter	17.183	0.0	252
360 min Winter	12.816	0.0	372
480 min Winter	10.402	0.0	492
600 min Winter	8.838	0.0	612
720 min Winter	7.732	0.0	732
960 min Winter	6.253	0.0	972
1440 min Winter	4.625	0.0	1452
2160 min Winter	3.411	0.0	2172
2880 min Winter	2.744	0.0	2892
4320 min Winter	2.014	0.0	4332
5760 min Winter	1.618	0.0	5776
7200 min Winter	1.366	0.0	7216
8640 min Winter	1.190	0.0	8656
10080 min Winter	1.059	0.0	10096

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Model Details

Storage is Online Cover Level (m) 10.000

Infiltration Blanket Structure

Infiltration Coefficient Base (m/hr)	0.00000	Diameter/Width (m)	33.5
Safety Factor	2.0	Length (m)	2.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	9.700		

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Summary of Results for 100 year Return Period (+20%)

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.726	0.026	0.0	0.5	Flood Risk
30 min Summer	9.737	0.037	0.0	0.7	Flood Risk
60 min Summer	9.748	0.048	0.0	1.0	Flood Risk
120 min Summer	9.762	0.062	0.0	1.3	Flood Risk
180 min Summer	9.770	0.070	0.0	1.4	Flood Risk
240 min Summer	9.776	0.076	0.0	1.5	Flood Risk
360 min Summer	9.785	0.085	0.0	1.7	Flood Risk
480 min Summer	9.792	0.092	0.0	1.9	Flood Risk
600 min Summer	9.798	0.098	0.0	2.0	Flood Risk
720 min Summer	9.803	0.103	0.0	2.1	Flood Risk
960 min Summer	9.811	0.111	0.0	2.3	Flood Risk
1440 min Summer	9.823	0.123	0.0	2.5	Flood Risk
2160 min Summer	9.836	0.136	0.0	2.8	Flood Risk
2880 min Summer	9.846	0.146	0.0	3.0	Flood Risk
4320 min Summer	9.861	0.161	0.0	3.3	Flood Risk
5760 min Summer	9.873	0.173	0.0	3.5	Flood Risk
7200 min Summer	9.882	0.182	0.0	3.7	Flood Risk
8640 min Summer	9.890	0.190	0.0	3.9	Flood Risk
10080 min Summer	9.898	0.198	0.0	4.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	95.156	0.0	27
30 min Summer	65.779	0.0	42
60 min Summer	43.553	0.0	72
120 min Summer	27.859	0.0	132
180 min Summer	21.105	0.0	192
240 min Summer	17.183	0.0	252
360 min Summer	12.816	0.0	372
480 min Summer	10.402	0.0	492
600 min Summer	8.838	0.0	612
720 min Summer	7.732	0.0	732
960 min Summer	6.253	0.0	972
1440 min Summer	4.625	0.0	1452
2160 min Summer	3.411	0.0	2172
2880 min Summer	2.744	0.0	2892
4320 min Summer	2.014	0.0	4332
5760 min Summer	1.618	0.0	5776
7200 min Summer	1.366	0.0	7216
8640 min Summer	1.190	0.0	8656
10080 min Summer	1.059	0.0	10096

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Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	9.730	0.030	0.0	0.6	Flood Risk
30 min Winter	9.741	0.041	0.0	0.8	Flood Risk
60 min Winter	9.754	0.054	0.0	1.1	Flood Risk
120 min Winter	9.769	0.069	0.0	1.4	Flood Risk
180 min Winter	9.779	0.079	0.0	1.6	Flood Risk
240 min Winter	9.786	0.086	0.0	1.7	Flood Risk
360 min Winter	9.796	0.096	0.0	1.9	Flood Risk
480 min Winter	9.804	0.104	0.0	2.1	Flood Risk
600 min Winter	9.810	0.110	0.0	2.2	Flood Risk
720 min Winter	9.815	0.115	0.0	2.3	Flood Risk
960 min Winter	9.825	0.125	0.0	2.5	Flood Risk
1440 min Winter	9.838	0.138	0.0	2.8	Flood Risk
2160 min Winter	9.853	0.153	0.0	3.1	Flood Risk
2880 min Winter	9.864	0.164	0.0	3.3	Flood Risk
4320 min Winter	9.880	0.180	0.0	3.7	Flood Risk
5760 min Winter	9.893	0.193	0.0	3.9	Flood Risk
7200 min Winter	9.904	0.204	0.0	4.1	Flood Risk
8640 min Winter	9.913	0.213	0.0	4.3	Flood Risk
10080 min Winter	9.921	0.221	0.0	4.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	95.156	0.0	27
30 min Winter	65.779	0.0	42
60 min Winter	43.553	0.0	72
120 min Winter	27.859	0.0	132
180 min Winter	21.105	0.0	192
240 min Winter	17.183	0.0	252
360 min Winter	12.816	0.0	372
480 min Winter	10.402	0.0	492
600 min Winter	8.838	0.0	612
720 min Winter	7.732	0.0	732
960 min Winter	6.253	0.0	972
1440 min Winter	4.625	0.0	1452
2160 min Winter	3.411	0.0	2172
2880 min Winter	2.744	0.0	2892
4320 min Winter	2.014	0.0	4332
5760 min Winter	1.618	0.0	5776
7200 min Winter	1.366	0.0	7216
8640 min Winter	1.190	0.0	8656
10080 min Winter	1.059	0.0	10096

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Model Details

Storage is Online Cover Level (m) 10.000

Infiltration Blanket Structure

Infiltration Coefficient Base (m/hr)	0.00000	Diameter/Width (m)	22.5
Safety Factor	2.0	Length (m)	3.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	9.700		

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Summary of Results for 100 year Return Period (+20%)

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.727	0.027	0.0	0.9	Flood Risk
30 min Summer	9.737	0.037	0.0	1.2	Flood Risk
60 min Summer	9.749	0.049	0.0	1.6	Flood Risk
120 min Summer	9.763	0.063	0.0	2.1	Flood Risk
180 min Summer	9.771	0.071	0.0	2.4	Flood Risk
240 min Summer	9.777	0.077	0.0	2.6	Flood Risk
360 min Summer	9.786	0.086	0.0	2.9	Flood Risk
480 min Summer	9.794	0.094	0.0	3.1	Flood Risk
600 min Summer	9.799	0.099	0.0	3.3	Flood Risk
720 min Summer	9.804	0.104	0.0	3.5	Flood Risk
960 min Summer	9.812	0.112	0.0	3.8	Flood Risk
1440 min Summer	9.825	0.125	0.0	4.2	Flood Risk
2160 min Summer	9.838	0.138	0.0	4.6	Flood Risk
2880 min Summer	9.848	0.148	0.0	4.9	Flood Risk
4320 min Summer	9.863	0.163	0.0	5.4	Flood Risk
5760 min Summer	9.875	0.175	0.0	5.8	Flood Risk
7200 min Summer	9.884	0.184	0.0	6.1	Flood Risk
8640 min Summer	9.893	0.193	0.0	6.4	Flood Risk
10080 min Summer	9.900	0.200	0.0	6.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	95.156	0.0	27
30 min Summer	65.779	0.0	42
60 min Summer	43.553	0.0	72
120 min Summer	27.859	0.0	132
180 min Summer	21.105	0.0	192
240 min Summer	17.183	0.0	252
360 min Summer	12.816	0.0	372
480 min Summer	10.402	0.0	492
600 min Summer	8.838	0.0	612
720 min Summer	7.732	0.0	732
960 min Summer	6.253	0.0	972
1440 min Summer	4.625	0.0	1452
2160 min Summer	3.411	0.0	2172
2880 min Summer	2.744	0.0	2892
4320 min Summer	2.014	0.0	4332
5760 min Summer	1.618	0.0	5776
7200 min Summer	1.366	0.0	7216
8640 min Summer	1.190	0.0	8656
10080 min Summer	1.059	0.0	10096

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Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	9.730	0.030	0.0	1.0	Flood Risk
30 min Winter	9.741	0.041	0.0	1.4	Flood Risk
60 min Winter	9.755	0.055	0.0	1.8	Flood Risk
120 min Winter	9.770	0.070	0.0	2.3	Flood Risk
180 min Winter	9.780	0.080	0.0	2.7	Flood Risk
240 min Winter	9.787	0.087	0.0	2.9	Flood Risk
360 min Winter	9.797	0.097	0.0	3.2	Flood Risk
480 min Winter	9.805	0.105	0.0	3.5	Flood Risk
600 min Winter	9.811	0.111	0.0	3.7	Flood Risk
720 min Winter	9.817	0.117	0.0	3.9	Flood Risk
960 min Winter	9.826	0.126	0.0	4.2	Flood Risk
1440 min Winter	9.840	0.140	0.0	4.7	Flood Risk
2160 min Winter	9.855	0.155	0.0	5.2	Flood Risk
2880 min Winter	9.866	0.166	0.0	5.5	Flood Risk
4320 min Winter	9.882	0.182	0.0	6.1	Flood Risk
5760 min Winter	9.895	0.195	0.0	6.5	Flood Risk
7200 min Winter	9.906	0.206	0.0	6.9	Flood Risk
8640 min Winter	9.916	0.216	0.0	7.2	Flood Risk
10080 min Winter	9.924	0.224	0.0	7.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	95.156	0.0	27
30 min Winter	65.779	0.0	42
60 min Winter	43.553	0.0	72
120 min Winter	27.859	0.0	132
180 min Winter	21.105	0.0	192
240 min Winter	17.183	0.0	252
360 min Winter	12.816	0.0	372
480 min Winter	10.402	0.0	492
600 min Winter	8.838	0.0	612
720 min Winter	7.732	0.0	732
960 min Winter	6.253	0.0	972
1440 min Winter	4.625	0.0	1452
2160 min Winter	3.411	0.0	2172
2880 min Winter	2.744	0.0	2892
4320 min Winter	2.014	0.0	4332
5760 min Winter	1.618	0.0	5776
7200 min Winter	1.366	0.0	7216
8640 min Winter	1.190	0.0	8656
10080 min Winter	1.059	0.0	10096

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Model Details

Storage is Online Cover Level (m) 10.000

Infiltration Blanket Structure

Infiltration Coefficient Base (m/hr)	0.00000	Diameter/Width (m)	10.8
Safety Factor	2.0	Length (m)	10.3
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	9.700		

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Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	8.963	0.463	1.6	67.8	O K
30 min Summer	9.099	0.599	1.6	93.6	O K
60 min Summer	9.235	0.735	1.6	122.4	O K
120 min Summer	9.365	0.865	1.6	153.0	O K
180 min Summer	9.432	0.932	1.6	170.1	O K
240 min Summer	9.473	0.973	1.6	180.8	O K
360 min Summer	9.523	1.023	1.7	194.2	O K
480 min Summer	9.551	1.051	1.7	202.1	O K
600 min Summer	9.567	1.067	1.7	206.7	O K
720 min Summer	9.575	1.075	1.7	209.0	O K
960 min Summer	9.577	1.077	1.7	209.6	O K
1440 min Summer	9.566	1.066	1.7	206.3	O K
2160 min Summer	9.540	1.040	1.7	198.9	O K
2880 min Summer	9.511	1.011	1.7	191.0	O K
4320 min Summer	9.451	0.951	1.6	174.8	O K
5760 min Summer	9.391	0.891	1.6	159.4	O K
7200 min Summer	9.331	0.831	1.6	144.8	O K
8640 min Summer	9.272	0.772	1.6	131.0	O K
10080 min Summer	9.215	0.715	1.6	118.0	O K
15 min Winter	9.009	0.509	1.6	76.2	O K
30 min Winter	9.155	0.655	1.6	105.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	95.156	0.0	68.9	26
30 min Summer	65.779	0.0	95.0	41
60 min Summer	43.553	0.0	127.1	70
120 min Summer	27.859	0.0	162.5	130
180 min Summer	21.105	0.0	184.6	188
240 min Summer	17.183	0.0	200.3	248
360 min Summer	12.816	0.0	223.7	366
480 min Summer	10.402	0.0	241.2	484
600 min Summer	8.838	0.0	253.1	604
720 min Summer	7.732	0.0	256.3	722
960 min Summer	6.253	0.0	255.3	932
1440 min Summer	4.625	0.0	251.3	1158
2160 min Summer	3.411	0.0	358.9	1548
2880 min Summer	2.744	0.0	384.8	1964
4320 min Summer	2.014	0.0	422.3	2776
5760 min Summer	1.618	0.0	454.3	3632
7200 min Summer	1.366	0.0	479.4	4408
8640 min Summer	1.190	0.0	501.1	5200
10080 min Summer	1.059	0.0	520.1	6048
15 min Winter	95.156	0.0	77.1	26
30 min Winter	65.779	0.0	105.9	41

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Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.301	0.801	1.6	137.7	O K
120 min Winter	9.442	0.942	1.6	172.6	O K
180 min Winter	9.516	1.016	1.7	192.4	O K
240 min Winter	9.561	1.061	1.7	204.9	O K
360 min Winter	9.618	1.118	1.7	221.2	O K
480 min Winter	9.652	1.152	1.8	231.4	O K
600 min Winter	9.673	1.173	1.8	237.8	O K
720 min Winter	9.686	1.186	1.8	241.7	O K
960 min Winter	9.696	1.196	1.8	244.9	O K
1440 min Winter	9.684	1.184	1.8	241.1	O K
2160 min Winter	9.652	1.152	1.8	231.4	O K
2880 min Winter	9.613	1.113	1.7	219.8	O K
4320 min Winter	9.526	1.026	1.7	195.1	O K
5760 min Winter	9.436	0.936	1.6	171.1	O K
7200 min Winter	9.347	0.847	1.6	148.7	O K
8640 min Winter	9.258	0.758	1.6	127.7	O K
10080 min Winter	9.165	0.665	1.6	107.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	43.553	0.0	142.3	70
120 min Winter	27.859	0.0	181.9	128
180 min Winter	21.105	0.0	206.6	186
240 min Winter	17.183	0.0	224.0	244
360 min Winter	12.816	0.0	249.0	360
480 min Winter	10.402	0.0	260.1	476
600 min Winter	8.838	0.0	261.4	590
720 min Winter	7.732	0.0	261.5	702
960 min Winter	6.253	0.0	261.6	924
1440 min Winter	4.625	0.0	263.6	1326
2160 min Winter	3.411	0.0	401.9	1652
2880 min Winter	2.744	0.0	430.8	2116
4320 min Winter	2.014	0.0	462.7	3028
5760 min Winter	1.618	0.0	508.8	3920
7200 min Winter	1.366	0.0	537.0	4760
8640 min Winter	1.190	0.0	561.2	5616
10080 min Winter	1.059	0.0	582.6	6456

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	115.6	1.500	373.6

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0061-2000-1500-2000
Design Head (m)	1.500
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	61
Invert Level (m)	8.500
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	2.0
Flush-Flo™	0.269	1.6
Kick-Flo®	0.545	1.3
Mean Flow over Head Range	-	1.5

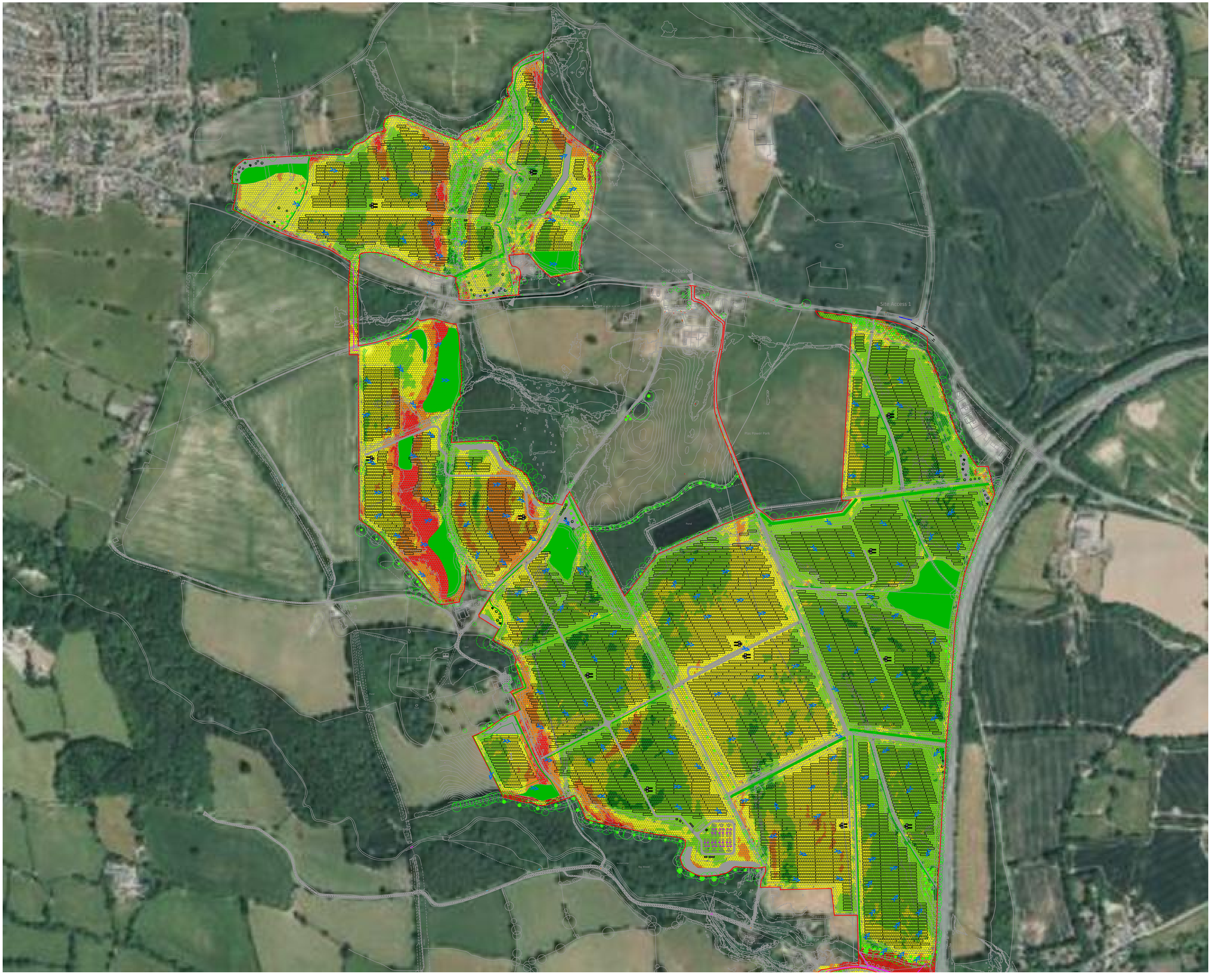
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.3	1.200	1.8	3.000	2.7	7.000	4.1
0.200	1.5	1.400	1.9	3.500	3.0	7.500	4.2
0.300	1.6	1.600	2.1	4.000	3.1	8.000	4.3
0.400	1.5	1.800	2.2	4.500	3.3	8.500	4.5
0.500	1.4	2.000	2.3	5.000	3.5	9.000	4.6
0.600	1.3	2.200	2.4	5.500	3.6	9.500	4.7
0.800	1.5	2.400	2.5	6.000	3.8		
1.000	1.7	2.600	2.6	6.500	3.9		

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Appendix G

Flow Exceedance Plan



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Notes

1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.
3. This drawing should be read in conjunction with all other relevant drawings and specifications.

FOR INFORMATION

KEY

Indicative overland flow exceedance route

2	Updated with new site layout	TJ	JM	02:02:24
1	Flow Exceedance Plan	AM	JM	23.10.23

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Client: Lightsource BP

Project: Plas Power Solar Farm

Title: Flow Exceedance Plan

Status	Scale	Date Created
DRAFT	1:1 @A1	19.09.23

Task Team Manager	Information Author	Task Information Manager
JM	TJ	JM

Document Number: HLEF 85062-RPS-PlasPower-FE-DR-1-190923

RPS Project Number	Revision
HLEF 85062	2

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