

Annex F – Drainage Technical Note

1 Introduction

1.1 Scheme Description and Background

- 1.1.1 Sunnica Energy Farm (hereafter referred to as the Scheme) is located within counties of Cambridgeshire and Suffolk and falling within the administrative areas of East Cambridgeshire District Council (ECDC) and West Suffolk Council (WSC). The location and Scheme components are described in more detail in **Chapters 2 and 3** of this Environmental Statement [EN010106/APP/6.1], respectively.
- 1.1.2 The Order limits covers an area of approximately 1,113 hectares, comprising arable fields interspersed with tree shelter belts (linear), small woodland and copses, agricultural fields, and farm access tracks and farm buildings.
- 1.1.3 The Scheme comprises two main sites: Sunnica West Site and Sunnica East Site. Both sites are split into Sunnica East Site A and B and Sunnica West Site A and B and connected by Grid Connection Routes A and B, with an extension to the existing Burwell National Grid Substation.
- 1.1.4 The maximum developable areas are as follows:
 - a. Sunnica East Site A – 115.0 ha
 - b. Sunnica East Site B – 227.0 ha
 - c. Sunnica West Site A – 256.0 ha
 - d. Sunnica West Site B – 23.0 ha
- 1.1.5 Totalling 621.00 ha, the remaining areas will be set aside for environmental and archaeological mitigation and cable routes.
- 1.1.6 The Sites (Sunnica East Site A, Sunnica East Site B, Sunnica West Site A and Sunnica West Site B) will comprise the principal infrastructure as follows:
 - a. Solar PV modules;
 - b. PV module mounting structures;
 - c. Inverters;
 - d. Transformers;
 - e. Switchgears;
 - f. Onsite cabling;
 - g. One or more Battery Energy Storage Systems (BESS) (expected to be formed of lithium ion batteries storing electrical energy);

- h. An electrical compound comprising a substation and control building (Sunnica East Site A, Sunnica East Site B and Sunnica West Site A only);
- i. Office/warehouse (Sunnica East Site A and Sunnica East Site B only)
- j. Fencing and security measures;
- k. Drainage;
- l. Internal access roads and car parking;
- m. Landscaping including habitat creation areas; and
- n. Construction laydown areas

1.1.7 This Drainage Technical Note sets out the outline drainage strategy for the Scheme, with regards to handling surface water generated within the PV panel areas, Compound and BESS areas.

1.1.8 No drainage is proposed for the cable routes; the cables will be buried, and the routes will be restored to greenfield conditions

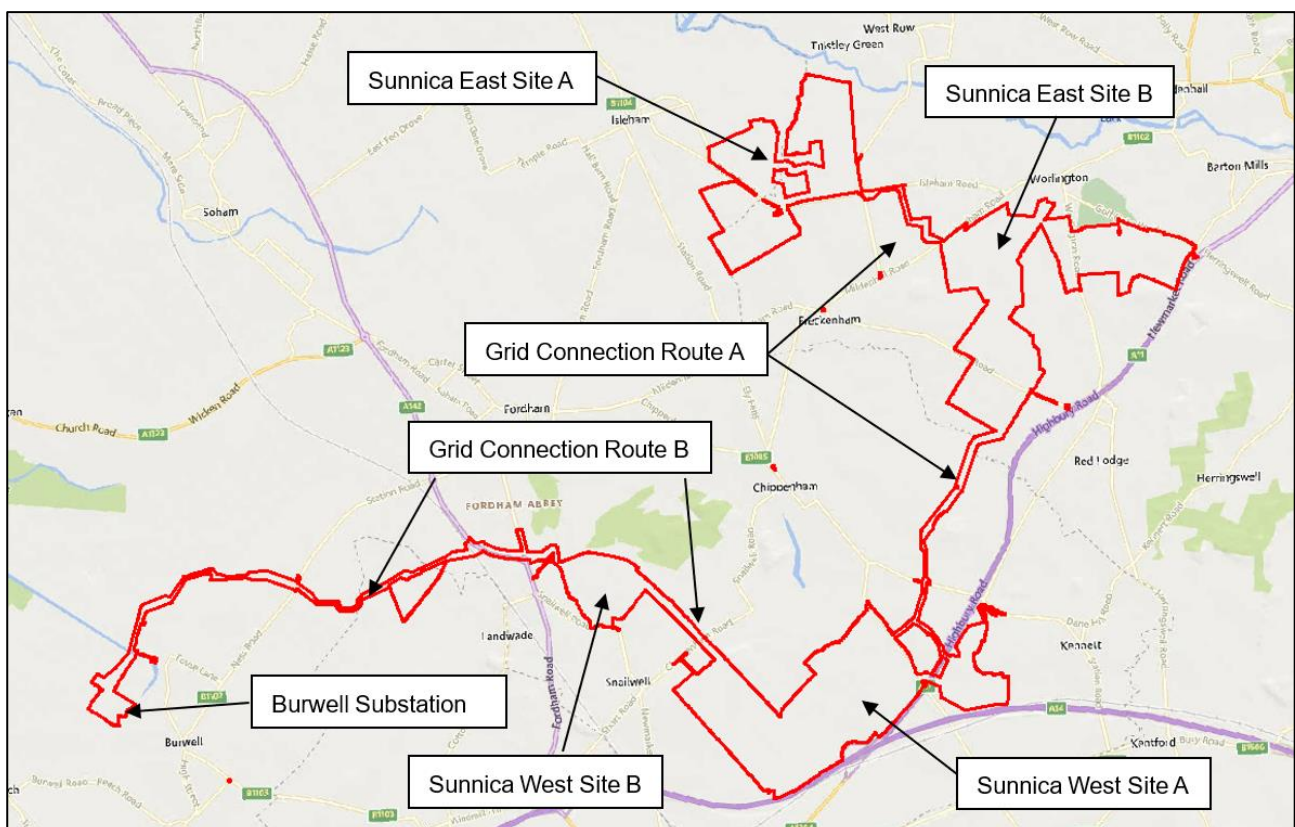


Figure 1 The Scheme

1.2 Design Assumptions

1.2.1 The following design assumptions have been used to produce this assessment.

- a. Existing levels for the areas listed in 1.1.7 have been taken from drone topographical survey conducted by Above Surveying Ltd on behalf of Sunnica Ltd.
- b. Due to the size of the Site, a ground investigation is cost prohibitive at this stage. Instead, information on the Sites ground conditions have been determined through a desktop study: British Geological Survey (BGS) show the majority of the south of the site lies within the Holywell Nodular Chalk Formation and Woburn Sands Formation, whilst the majority of the north of the site (Sunnica East sites A and B) lies in the Zig Zag Chalk Formation. Where the BGS had information on Superficial Deposits, they indicate areas of sand and gravel.
- c. An infiltration rate of 1×10^{-5} m/s has been assumed. This is based on a conservative infiltration rate estimation for soil suitable for infiltration, referenced from CIRIA SuDS Manual (C753).
- d. The drainage system has been designed to accommodate the 1 in 100-year storm, plus a 40% allowance for an increase in peak rainfall intensity due to climate change.
- e. A Volumetric Runoff Coefficient (C_v) of 1 has been used in this design. The percentage impermeable area (PIMP) value was assumed to be 10% equivalent for the solar fields and 100% for compound areas and 100% for the BESS areas.
- f. All swale features will avoid all archaeological sites and will maintain a minimum 10m buffer to watercourses and sensitive sites.
- g. No permanent water features are proposed. Surface water runoff will largely collect at existing low spots and infiltrate to ground, as existing. Bird strike risk from nearby aviation sites precludes any permanent water feature as part of the SuDS strategy
- h. Flood Studies Report (FSR) rainfall data has been used for this assessment.
- i. In accordance with BRE 365, a minimum of 1m should be provided between the base on any infiltration system and the groundwater table to allow for fluctuations in the groundwater level and to protect groundwater quality. As groundwater levels are not fully known at this stage, proposed infiltration attenuation features have been kept shallow (maximum depth of 600mm) to lower the possibility of encountering groundwater. Assumptions are also referred from Chapter 9 for anticipated ground conditions.

2 Supporting Information

2.1 Flood Risk

2.1.1 The potential flood risk to the Scheme is summarised in **Table 1** below. For further detail on the site's potential flood risk, refer to the Flood Risk Assessment (**Appendix 9C** of the Environmental Statement [**EN010106/APP/6.2**]).

Table 1 Flood Risk Summary

Flood Risk Source	Pre-Development Risk	Post Development Risk	Comments
Fluvial	Low	Low (Residual)	The majority of the Order limits are within Flood Zone 1, but certain areas lie in Flood Zone 2, 3a, 3b. No permanent above ground development will occur in Flood Zone 3b. Residual risk of PV panels within Flood Zone 3a has been taken into account with panels raised 0.85m above the ground level.
Tidal	Very Low	Very Low	Not in a tidal area
Pluvial (Surface Water)	Low	Low	Surface water risk varies throughout the Order limits indicating patches of the Order limits which are susceptible to surface water flooding. However, flooding is localised and generally shallow (low risk).
Groundwater	Medium	Medium	Groundwater risk also varies, with all Sites between <25% and >75%, therefore further ground investigation, groundwater monitoring and infiltration testing is proposed to confirm groundwater levels. Furthermore, both the Sunnica East Site B and Sunnica West Sites A and B Sites are shown to be within a Source Protection Zone III, with small areas of Source Protection Zone II. Therefore, infiltration techniques must ensure mitigation measures are put in effect to protect groundwater interaction in these areas.
Sewers	Low	Low	Sewer flood risk remains low
Artificial Sources	Low (residual)	Low (residual)	Statutory Reservoirs (large raised reservoirs with volumes above ground of 25,000m ³ or over) are regularly inspected and maintained as set out in the Reservoirs Act 1975. On that basis they are deemed to pose a low (residual) risk. Other artificial sources such as canals and waterways are considered to be regularly maintained and therefore only deemed to pose a low (residual) risk to the Scheme

2.2 Existing Drainage

- 2.2.1 The area within the Order limits is largely greenfield. It consists of individual trees, hedgerow, tree belts (linear) small woodland block, agricultural fields (arable) and farm access tracks. There is currently no formal piped drainage system within the Order Limits. It is assumed that for low intensity rainfall events, rainfall would infiltrate to ground where it lands. For rainfall events where rainfall intensity exceeds the local rate of infiltration, it is assumed that any runoff generated within the Order limits would naturally flow overland to low spots within the Order limits where it would collect and infiltrate as the event subsides. Where parts of the Order limits interact with watercourses, excess runoff will naturally drain from the catchment into the watercourse.

2.3 Geology and Hydrogeology

- 2.3.1 The bedrock and superficial geology for the area has been identified from mapping produced by the British Geological Survey. These maps indicate Superficial Deposits are absent for portions of the site. However, there are areas of sand and gravel from Glacial River Terrace Deposits throughout portions of the Order limits.
- 2.3.2 The Bedrock covering the majority of the south of the site is Holywell Nodular Chalk Formation and New Pit Chalk Formation, whilst the majority of the north of site is the Zig Zag Chalk Formation. Both bedrock geologies are chalk member formations.
- 2.3.3 The EA's Online Interactive Maps for Groundwater shows the site is situated partly within a Groundwater Source Protection Zone 3 (Total Catchment Zone). An SPZ typically means there is an underlying aquifer supplying a borehole for potable use.

3 Proposed Drainage Arrangements

3.1 Surface Water Drainage Strategy

- 3.1.1 As previously mentioned, the Scheme is largely a greenfield site. It is considered that rainfall will mostly permeate into the ground where it falls and that any runoff generated within arable fields collects in local low spots where it infiltrates to ground, or enter a watercourse as appropriate where the site drainage interacts with one. The proposed surface water drainage strategy for the Scheme areas noted in 1.1.7 aims to mimic the natural drainage conditions of the site as much as possible.
- 3.1.2 The proposed solar PV panels will be held above ground individually on narrow diameter piled legs (<100mm diameter). This prevents sealing the ground with an impermeable surface beneath solar panels allowing rainfall/runoff to infiltrate to ground throughout the Sites. As a result, it is considered that the site's impermeable area will remain consistent to its pre-development state.
- 3.1.3 To prevent ponding occurring around the solar panels or overland flow routes directing runoff off site, a series of swales and infiltration basins will be constructed within the solar PV panel fields in identified low spots throughout the Sites to collect and store runoff, allowing it to infiltrate to ground. The locations of the proposed swales and detention basins can be seen in outline drainage drawings WPP-ACM-XX-DR-C-ZZ-001 to WPP-ACM-XX-DR-C-ZZ-008, in Appendix F. Detailed drainage designs and SuDS feature locations will be determined post consent at detailed design stage.
- 3.1.4 Throughout the Sites, there are several areas demarcated as archaeology or heritage areas that will not contain solar PV panels or associated infrastructure. No drainage infrastructure is proposed for these areas. Swales or infiltration basins will be positioned to prevent any runoff from the solar panel fields flowing into these areas. Drawings WPP-ACM-XX-DR-C-ZZ-001 to WPP-ACM-XX-DR-C-ZZ-008 annotate the outline locations of these features, to be confirmed at detailed design, post consent. Within Sunnica East Sites A and B and Sunnica West Site B, there will also be compound areas and BESS and on-site substations that have an impermeable surface. The outline design of swales and detention basins have been sized to demonstrate there is sufficient capacity available to accommodate the increased runoff from these areas.

3.2 Contributing Areas

- 3.2.1 The total area contributing to the proposed drainage system is presented in **Table 2** below. In calculating this area, the following assumptions were made:
- Heritage, Archaeological Mitigation, Ecology Enhancement and Proposed Woodland areas were deemed to contribute 0% of their total area to runoff.
 - Compound areas would contribute 100% runoff with BESS and Substation areas were deemed to contribute 100% of their total area to runoff.

- c. As the solar panel fields are greenfield areas, the contributing area for calculations was pro-rata'd to represent an effective impermeable area in order to calculate runoff volumes using the MicroDrainage software, as it only allows impermeable areas to include in the calculation. It is generally accepted that 10% of the greenfield area would be a fair representation of the equivalent impermeable area to input into MicroDrainage or other modelling software, to enable a model to analyse greenfield runoff (modelling software does not inherently facilitate greenfield areas as a positive drainage catchment; drainage software defaults to impermeable contributing areas only (i.e. 100% impermeable). As previously mentioned, the solar PV panels will be held above ground on four-legged stands. This will allow most rainfall to infiltrate ground within the solar PV fields.
- d. Cable routes were not deemed to contribute any runoff to the drainage system. The proposed cable will be buried, and the greenfield conditions will be restored.

Table 2 Contributing Areas

	Area (ha)	Pre-Development PIMP* (%)	Post-Development PIMP* (%)	Post Development Greenfield Contributing Area (ha) as Effective Impermeable area	Post-Development Impermeable Areas (ha) (BESS / Compound Areas)	Effective combined Post-Development Contributing Area (ha) to proposed drainage system **
Sunnica West Sites A and B	542	0%	8%	33.4	8.8	42.2
Sunnica East Sites A and B	439	0%	11%	24.7	25.1	50.1
Cable Routes	132	0%	0%	0	0	0
TOTAL	1,113				TOTAL	92.3

*- Percentage Impermeable (PIMP)

** - Includes Solar Panel Sites and

3.3 Greenfield Runoff Rates

- 3.3.1 The equivalent greenfield runoff rates for the site have been calculated for the site using HR Wallingford's UKSuDS Greenfield Runoff Rate Estimation tool based on the proposed contributing impermeable area. These rates are shown in **Table 3**.

Table 3 Greenfield Discharge Rates

Return Period (years)	Discharge Rate (l/s) (1113 ha)
1	87.39
Qbar	100.45
30	246.10
100	357.60

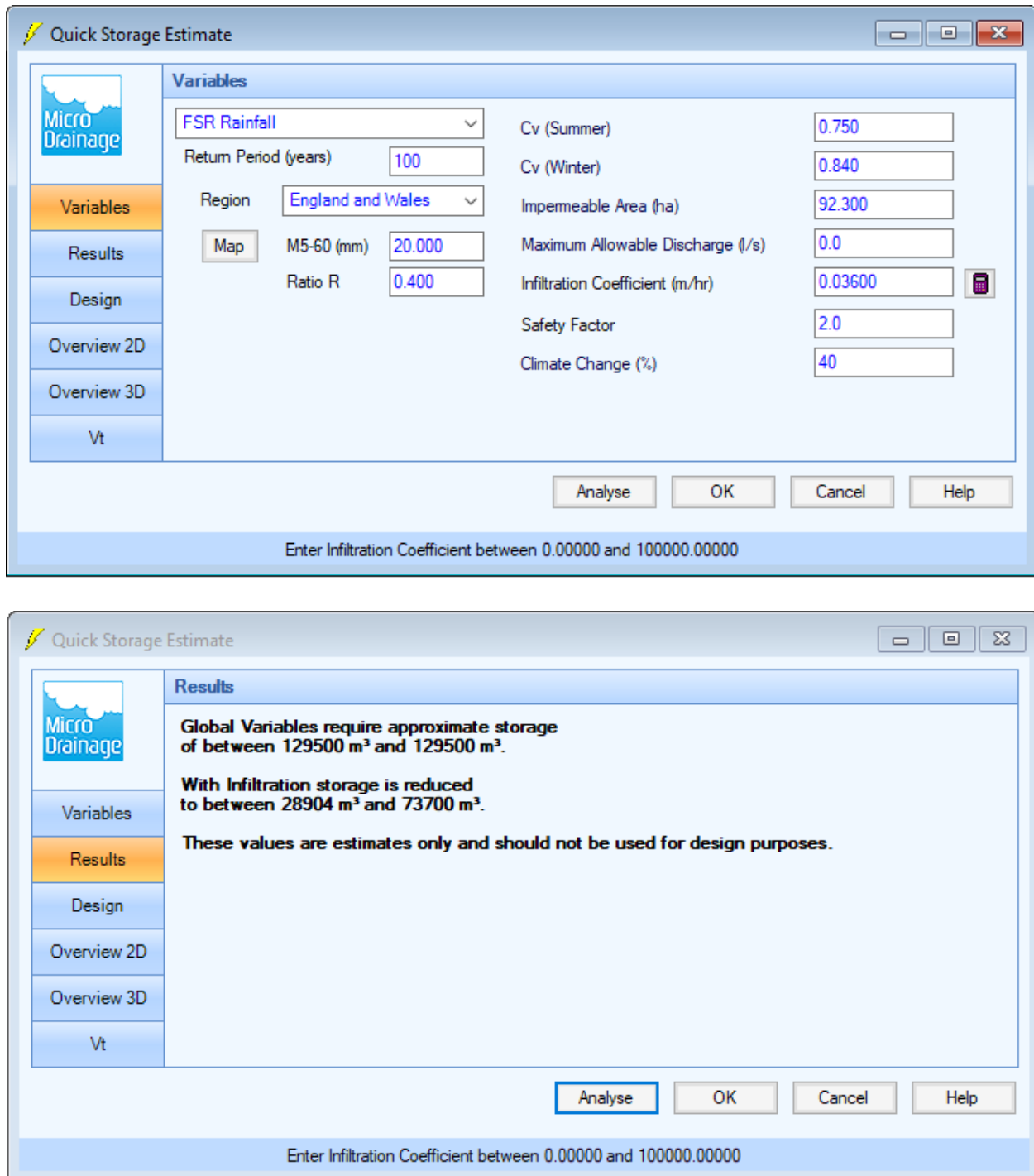
3.4 Proposed Discharge Rates

- 3.4.1 As mentioned earlier, it is not intended to discharge surface water runoff off-site. Instead any surface water runoff generated within the Sites will be disposed of via infiltration to mimic existing conditions. As a full ground investigation for the entire site would be cost prohibitive at this stage, the site's infiltration potential has been assessed based on the desktop study.
- 3.4.2 As mentioned earlier, the Sites lies in areas of sand and gravel; ground material typically associated with good infiltration rates. As a conservative approach, the Sites infiltration rate has been modelled with an infiltration rate of 1×10^{-5} m/s. The percentage of impermeable area for compound areas, BESS and on-site substations has not yet been confirmed; detailed layouts will be re-assessed post planning to ensure the SuDS strategy and required attenuation is provided. Taking a conservative approach, at present it is assumed 100% impermeable area for site compounds and sub-stations, and 100% impermeable for BESS areas, to account for fire water capture and runoff. Increases to existing contributing area are to be balanced by infiltration techniques, with exceedance flows captured by surrounding swales.

3.5 Proposed Attenuation

- 3.5.1 Attenuation will be required onsite to temporarily store any surface water runoff generated within the site boundary before it is infiltrated to ground. Attenuation will be provided in the form of swales and infiltration basins. These features have will be strategically located based on existing overland flow routes to capture runoff. The swales/infiltration basins will be 600 mm deep with minimum 1 in 3 side slopes. Check dams will be placed strategically within swales to optimise their storage potential on steeper slopes Where the attenuation lies within the solar field, the legs of the solar panel will be extended so that the solar panel lies above any potential flooding. The outline strategy presents locations for attenuation, which will be refined during detail design, post consent.
- 3.5.2 The attenuation features have been sized to accommodate the 1 in 100 year event plus a 40% allowance for climate change. The required storage volume was

determined for the entire site using the MicroDrainage 'Quick Storage Estimate' tool. The volume of storage required for specific solar fields, compound area or substation areas was determined proportionately based on the contributing area. The 'Quick Storage Estimate' tool provides an upper and lower estimate for the storage volume required, as shown in **Figure 2**.



The figure displays two screenshots of the MicroDrainage 'Quick Storage Estimate' tool interface.

Top Screenshot: Variables Input

Variable	Value
FSR Rainfall	100
Return Period (years)	100
Region	England and Wales
Map	M5-60 (mm)
Ratio R	0.400
Cv (Summer)	0.750
Cv (Winter)	0.840
Impermeable Area (ha)	92.300
Maximum Allowable Discharge (l/s)	0.0
Infiltration Coefficient (m/hr)	0.03600
Safety Factor	2.0
Climate Change (%)	40

Buttons: Analyse, OK, Cancel, Help

Footer: Enter Infiltration Coefficient between 0.00000 and 100000.00000

Bottom Screenshot: Results

Global Variables require approximate storage of between 129500 m³ and 129500 m³.

With Infiltration storage is reduced to between 28904 m³ and 73700 m³.

These values are estimates only and should not be used for design purposes.

Buttons: Analyse, OK, Cancel, Help

Footer: Enter Infiltration Coefficient between 0.00000 and 100000.00000

Figure 2 MicroDrainage Quick Storage Estimator Analysis for BESS/Compound Areas

3.5.3 The Scheme will provide minimal alterations to the existing topography and ground conditions on-site. It was therefore assumed a portion of runoff generated would infiltrate to ground before it reached a proposed storage feature or would become trapped in a local low spot. As such, it was decided that the upper estimate for the storage volume required would result in redundant storage. The required storage volume was therefore based on the average of the upper and lower estimate. The total storage to be provide onsite is presented in **Table 4** below. For a detail breakdown of the storage to provide for each catchment, refer to Appendix C.

3.5.4 Details of the proposed storage features are shown below in **Table 4**.

Table 4 Proposed Storage Features

Total storage required (m ³) *	Total storage provided (m ³)
28,904 to 73,700 (average: 51,302)	55,869.20

3.6 Water Quality

3.6.1 CIRIA C753 The SuDS Manual states that “SuDS provide an opportunity to capture and treat runoff by intercepting, filtering, and degrading pollutants, and by reducing the volume of potentially contaminated water...while at the same time conveying, storing and infiltrating surface water to protect flood risk, river morphology and water resources, and delivering amenity and biodiversity value for the development”. In order to assess the risk to receiving watercourses an assessment has been undertaken of the proposed surface water drainage system in accordance with the SuDS manual. This is a simplistic method that can be used to assess the level of treatment a drainage system could potentially provide to captured surface water runoff.

3.6.2 This method is known as the Simple Index Approach; it states the following:

$$\text{Total SuDS Mitigation Index} \geq \text{Pollution hazard index}$$

3.6.3 The SuDS manual only provides a limited number of land uses. The land uses in **Table 5** below were chosen as the most suitable components of the Scheme. The pollution hazard indices for solar PV panels were based on residential roofs as the outside casing of the panel is constructed from glass and is unlikely to create a significant pollution risk (no oil / fluid is present in the panels etc).

3.6.4 Surface water runoff from the solar PV panel fields, compound areas, BESS and substation areas will drain runoff overland to either swales or infiltration basins. From here, runoff will infiltrate to ground. Table 5 below lists the pollutant hazard indices and mitigation indices used as part of the Simple Index Approach (SIA) and demonstrates the proposed SuDS are sufficient to treat the Scheme runoff.

3.6.5 The impermeable areas chosen within the simple index method below consist of the solar PV panels and the low traffic roads and non-residential car parking with infrequent movements. The areas containing BESS and transformers are contained within the ‘low traffic roads’ as they are self-contained containers or

bunded areas. Under normal operation, runoff from these areas is considered to be low risk as it will be treated as roof / road runoff.

- 3.6.6 Firefighting water, and its potential containments, is not included here as any fire water applied to BESS areas would be contained within a separate lagoon structure and removed from site via controlled methods (e.g. tanker) if the water is polluted, i.e. it will not drain into the surface water drainage network without prior testing to confirm it is clean water (please see section below on Fire Water Runoff).

Table 5 Assessment against CIRIA C753 The SuDS Manual Sample Index Approach

Land use	Pollution Hazard Indices			
	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Solar PV panels*	Very Low	0.2	0.2	0.05
Low Traffic roads and non-residential car parking with infrequent change (i.e. <300 traffic movements/day)**	Low	0.5	0.4	0.4
Total Pollution index		0.7	0.6	0.45
*The pollution hazard indices for solar panels has been based on residential roofs.				
**Compound areas and substation areas				
Type of SuDS Component	Mitigation indices			
		TSS	Metals	Hydrocarbons
Swales		0.5	0.6	0.6
Infiltration Basin		0.5	0.5	0.6
Total Mitigation Index		1.0	1.1	1.2

- 3.6.7 From the above assessment the results are calculated, a pass is where the total mitigation index is greater than the pollution hazard index. According to the SIA, with the provision of swales and infiltration basins, there is adequate treatment being provided for the key pollutants considered by the SIA of the SuDS manual (i.e. TSS, metals and hydrocarbons).

3.7 Exceedance Flows

- 3.7.1 The proposed surface water drainage network has been designed to accommodate runoff from all storms up to and including the 100 year +40% return period. For an extreme storm event, any exceedance flows that cannot be retained by the proposed attenuation flow overland, following the existing topography, where ultimately, they will be contained within the SuDS features. The swale capacity can theoretically contain a in 100 year runoff event, including climate change with little to no infiltration.

3.8 Amenity and Ecological Value of SuDS Features

- 3.8.1 Due to the nature of the Scheme, personnel involved in the Scheme will have minimal interaction with the proposed drainage features. Consequently, the potential amenity benefit provided by the drainage is not considered relevant to the design. The design of the drainage, however, will be discreet so that it does not hinder the aesthetic value of the Sites.
- 3.8.2 Incorporating swales and infiltration basins within the Sites should maintain some ecological value within the fields that may be lost from the introduction of solar panels.

3.9 Impact on Sites of Special Scientific Interest (SSSI) Sites

- 3.9.1 Drainage is primarily designed to intercept increased impermeable area runoff from the Sites. Solar panel field runoff has been treated as greenfield runoff. Surface water is to be collected and treated in Swales to improve water quality and largely infiltrate to ground as per existing regime. Excess flows will enter the watercourses, although regular inflows may be less from these solar panel areas, i.e. there is an overall presumption of reduced flood risk downstream through the proposals

Snailwell Fen SSSI

- 3.9.2 Sunnica West Site A drains away from the SSSI, naturally following the topography (Chippenham Road is a watershed line effectively). Surface water in Sunnica West Site B is to be collected and treated in Swales to improve water quality. In this parcel, the drainage generally falls within the site to low spots with a small portion west to the River Snail; any drainage to the far west adjacent to the River Snail joins downstream of the SSSI, so there is minimal impact.
- 3.9.3 There will be no increase in runoff volumes, and no reduction in water quality. It is considered the drainage catchment for the Site does not affect the primary River Snail catchment and spring upstream which would feed the majority of water for the Snailwell SSSI. Runoff from firewater from the battery storage area will be captured so it cannot discharge off site or to ground and will be tested/removed by tanker off site if contamination is found to be present.

Chippenham Fen and Snailwell Poor's Fen

- 3.9.4 As mentioned above, the proposed drainage network is largely contained within the Sites, as there are natural low-lying areas. The Sites are also downstream of the Chippenham SSSI, so impact to SSSI is considered negligible from all elements of drainage. There will be no reduction in water quality entering watercourses or groundwater through the current drainage proposals.
- 3.9.5 Refer to **Figure 3** below for SSSI location adjacent to Sunnica West Site B (Proposed Swales shown as green lines),

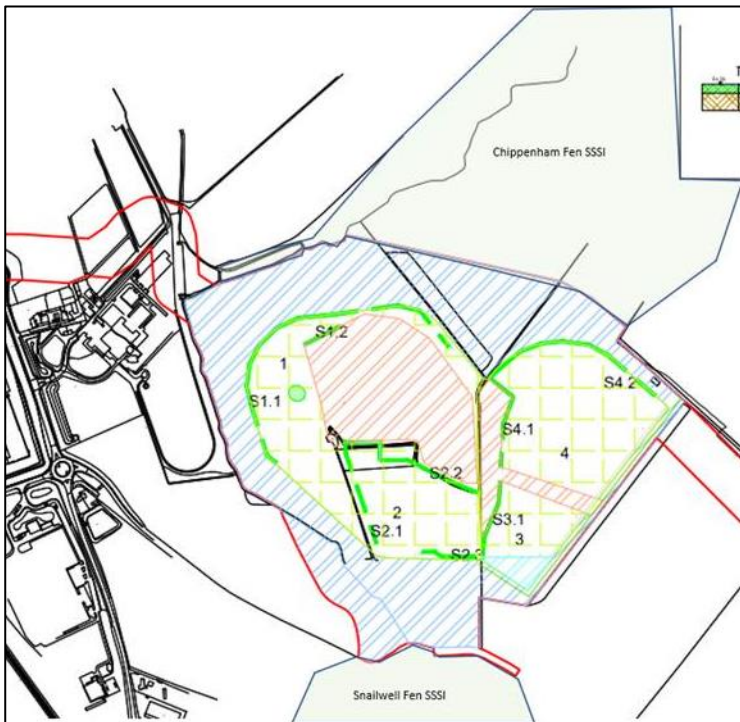


Figure 3 SSSI Sites in relation to Sunnica West Site B

3.10 Fire Water Runoff

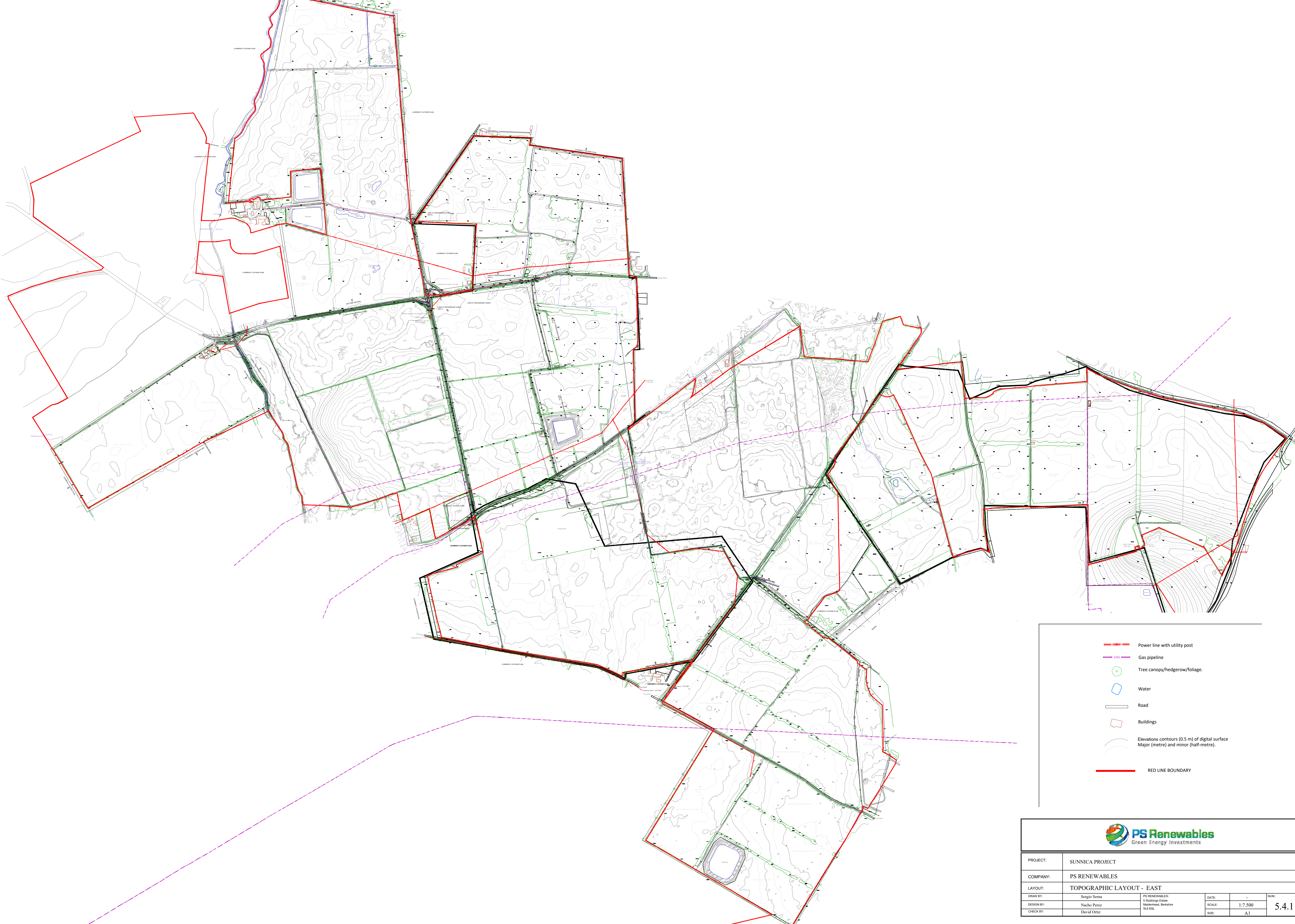
- 3.10.1 The BESS areas require fire water tanks to suppress a fire, should one break out in the BESS containers.
- 3.10.2 A fire strategy has been prepared as part of the development proposals. Fire water tanks are to be located at each BESS site, capable of retaining 242.5m³ water per site. The tanks are to be filled with standard water, with no chemical additives.
- 3.10.3 Should a fire break out in a container, the strategy proposes to contain fire within the individual container by using automated fire suppression. This water will be contained in a Sump within the battery container and transported off-site. Fire water will be used to soak nearby containers to prevent heat transfer and damage to other containers, see Outline Battery Fire Safety Management Plan **[EN010106/APP/7.6]**.
- 3.10.4 Fire water runoff may, however, contain particles from a fire. In the unlikely event of fire water being discharged, the runoff must be contained and tested/treated before being allowed to discharge to the proposed SuDS (watercourse / infiltration).
- 3.10.5 It is proposed to contain the fire water runoff within a bunded lagoon structure where it can be held and tested before either being released into the SuDS system or taken off site by a tanker for treatment elsewhere. The lagoon will then be cleaned of all contaminants.

- 3.10.6 The lagoon will be controlled by a penstock valve that can be automatically closed during a fire, i.e. under normal circumstances rainfall will be allowed to drain through the lagoon into the SuDS system.
- 3.10.7 The lagoons will be 0.6m deep and 410m² in area. This is to allow attenuation of the 242.5m³ fire water runoff plus an additional 10% capacity.

3.11 Adoption and Maintenance

- 3.11.1 The proposed drainage strategy will be maintained by the Applicant or a private company employed by the Applicant. All proposed drainage features should be maintained according to standard practice. Refer to Appendix E for maintenance schedules of proposed SuDS features.

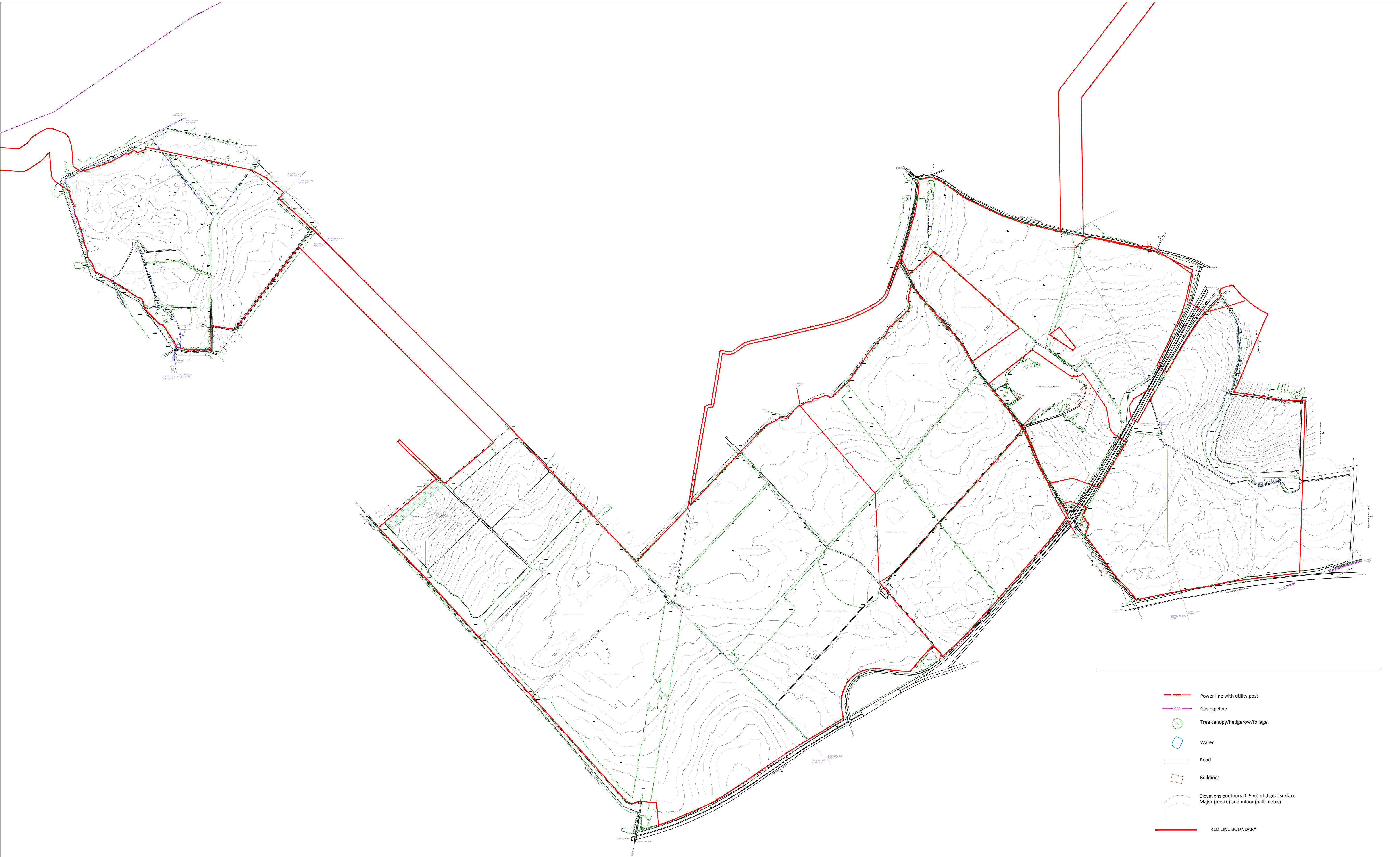
Sub-Annex A Topographic Surveys



- Power line with utility post
- Gas pipeline
- Tree canopy/hedgerow/foilage.
- Water
- Road
- Buildings
- Elevations contours (0.5 m) of digital surface
Major (metre) and minor (half-metre).
- RED LINE BOUNDARY



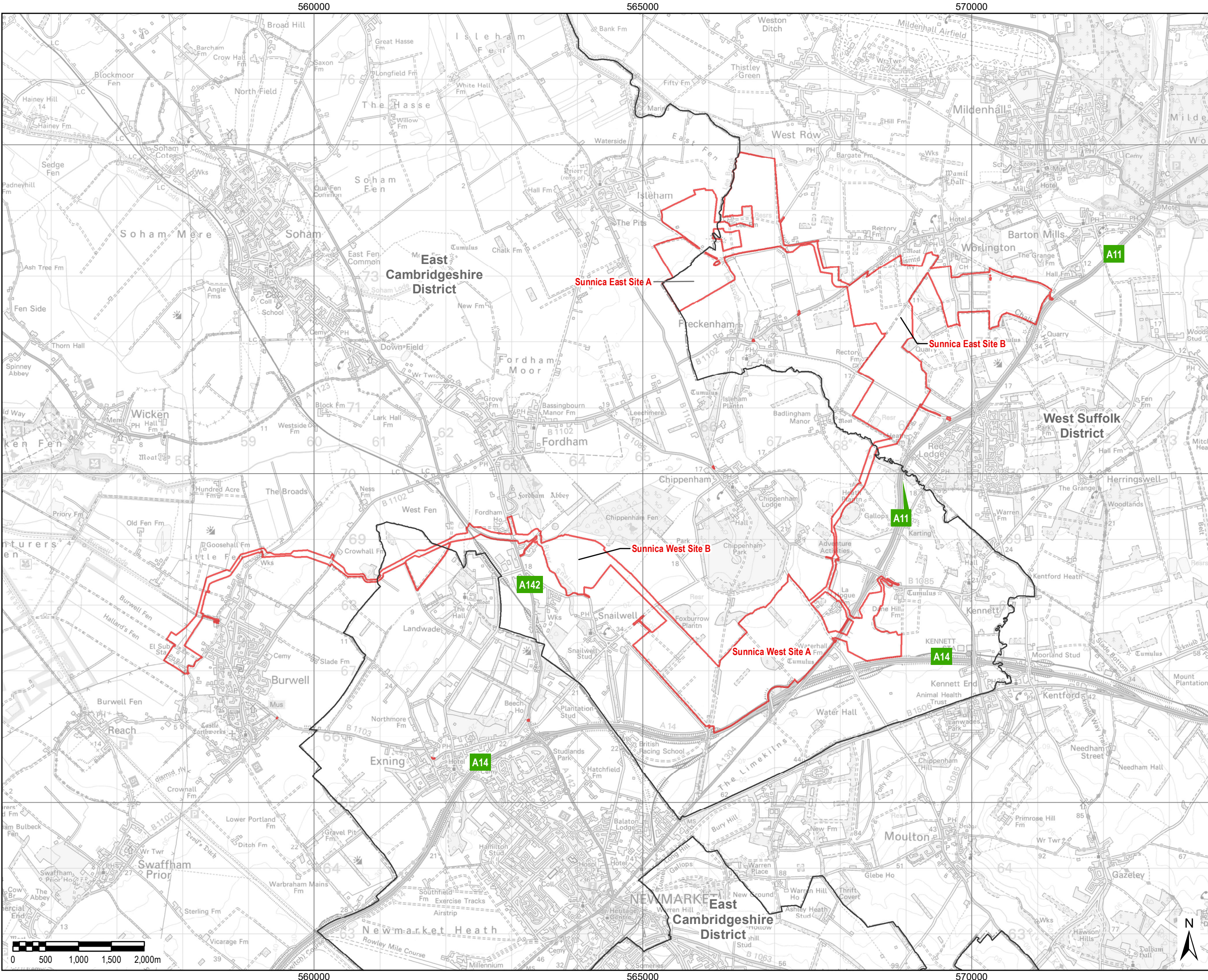
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COMPANY:	PS RENEWABLES					
LAYOUT:	TOPOGRAPHIC LAYOUT - EAST					
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DESIGN BY:	Nacho Perez	5 Shalanga Estate	SCALE:	1:7,500		5.4.1
CHECK BY:	David Ortiz	Maintenance, Benkeke BLG 60L	SIZE:	A1		



PROJECT:	SUNNICA PROJECT				
COMPANY:	PS RENEWABLES				
LAYOUT:	TOPOGRAPHIC LAYOUT - WEST				
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DESIGN BY:	Nacho Perez	5 Shalanga Estate	SCALE:	1:7,500	5.4.2
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Sub-Annex B Order limits

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LEGEND

- The Order limits
- Local Authority Boundary

NOTE:

Public highways run through the Sunnica East Site, which are not part of the site boundary. These have been digitised based on the 1:1250 scale OS Mastermap.

Small areas of the Order limits are shown on some small sections of roads where works will need to be undertaken to accommodate construction traffic.


High voltage cables will be required to cross internal roads and to connect areas of the sites throughout. These are not shown on the plans.

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Sub-Annex C Proposed Attenuation Volume

Catchment No.	Area (ha.)	PIMP	Impermeable Area (ha.)	Storage Required (m³)	Total Volume Available (m³)	Ref S.C _n .1	Ref S.C _n .2	Ref S.C _n .3	Ref S.C _n .4	Ref S.C _n .5	Ref P.C _n .1	Ref P.C _n .2	Ref P.C _n .3	Ref P.C _n .4
1	5.1	10%	0.5	288	837	679	79	79	0	0	0	0	0	0
2	5.4	10%	0.5	310	640	213	319	108	0	0	0	0	0	0
3	3.2	10%	0.3	185	160	160	0	0	0	0	0	0	0	0
4	8.9	10%	0.9	506	583	326	257	0	0	0	0	0	0	0
5	32.1	10%	3.2	1826	679	447	231	0	0	0	0	0	0	0
6	26.5	10%	2.6	1506	638	638	0	0	0	0	0	0	0	0
7	25.3	10%	2.5	1438	618	618	0	0	0	0	0	0	0	0
8	7.1	10%	0.7	402	383	383	0	0	0	0	0	0	0	0
9	4.3	10%	0.4	245	304	153	151	0	0	0	0	0	0	0
10	23.3	10%	2.3	1327	548	386	162	0	0	0	0	0	0	0
11	23.3	10%	2.3	1328	609	609	0	0	0	0	0	0	0	0

Catchment No.	Area (ha.)	PIMP	Impermeable Area (ha.)	Storage Required (m³)	Total Volume Available (m³)	Ref S.C _{n.1}	Ref S.C _{n.2}	Ref S.C _{n.3}	Ref S.C _{n.4}	Ref S.C _{n.5}	Ref P.C _{n.1}	Ref P.C _{n.2}	Ref P.C _{n.3}	Ref P.C _{n.4}
12	19.5	10%	2.0	1111	1962	253	329	480	0	0	900	0	0	0
13	8.8	100%	8.8	7287	872	228	397	248	0	0	0	0	0	0
14	12.8	10%	1.3	729	729	446	284	0	0	0	0	0	0	0
15	19.6	10%	2.0	1114	765	342	423	0	0	0	0	0	0	0
16	15.2	10%	1.5	862	1297	244	153	0	0	0	900	0	0	0
17	13.9	10%	1.4	790	1198	190	117	76	315	0	200	300	0	0
18	22.5	10%	2.3	1282	1888	488	0	0	0	0	700	700	0	0
19	25.5	10%	2.6	1451	1466	0	366	302	270	528	0	0	0	0
20			NO LONGER USED											
21			NO LONGER USED											
22			NO LONGER USED											
23	11.9	10%	1.2	679	443	283	160	0	0	0	0	0	0	0
24	15.8	10%	1.6	669	1380	180	0	0	0	0	400	400	400	0

Catchment No.	Area (ha.)	PIMP	Impermeable Area (ha.)	Storage Required (m³)	Total Volume Available (m³)	Ref S.C _n .1	Ref S.C _n .2	Ref S.C _n .3	Ref S.C _n .4	Ref S.C _n .5	Ref P.C _n .1	Ref P.C _n .2	Ref P.C _n .3	Ref P.C _n .4
25	11.8	10%	1.2	900	520	179	341	0	0	0	0	0	0	0
26	4.3	10%	0.4	247	374	184	190	0	0	0	0	0	0	0
27	4	100%	4.0	5501	740	162	228	138	212	0	0	0	0	0
28	8.4	100%	8.4	2021	401	236	166	0	0	0	0	0	0	0
29	9.9	10%	1.0	564	2000	0	0	0	0	0	2000	0	0	0
30	3.3	10%	0.3	187	300	0	0	0	0	0	300	0	0	0
31	7.9	10%	0.8	450	4059	203	157	0	0	0	3700	0	0	0
32	15.7	10%	1.6	894	1202	140	89	157	149	216	150	150	150	150
33	15.0	10%	1.5	855	1284	520	164	0	0	0	300	300	0	0
34	17.0	10%	1.7	964	1420	177	146	97	0	0	300	400	300	0
35	5.4	10%	0.5	307	787	241	195	0	0	0	200	150	0	0
36	10.2	10%	1.0	600	643	293	0	0	0	0	350	0	0	0
37	NO LONGER USED													

Catchment No.	Area (ha.)	PIMP	Impermeable Area (ha.)	Storage Required (m³)	Total Volume Available (m³)	Ref S.C _n .1	Ref S.C _n .2	Ref S.C _n .3	Ref S.C _n .4	Ref S.C _n .5	Ref P.C _n .1	Ref P.C _n .2	Ref P.C _n .3	Ref P.C _n .4
38	7.4	10%	0.7	422	700	0	0	0	0	0	700	0	0	0
39	8.7	10%	0.9	492	1125	309	159	257	0	0	400	0	0	0
40	11.3	10%	1.1	641	942	176	417	0	0	0	350	0	0	0
41	11.1	10%	1.1	632	3623	140	483	0	0	0	1000	1000	1000	0
42	47.0	10%	4.7	2736	4418	1368	0	0	0	0	350	2700	0	0
43	3.8	10%	0.4	219	400	0	0	0	0	0	400	0	0	0
44	9.0	10%	0.9	559	834	211	330	293	0	0	0	0	0	0
45	8.1	100%	8.1	1916	3000	0	0	0	0	0	3000	0	0	0
46	9.0	10%	0.9	513	711	176	134	0	0	0	400	0	0	0
47	8.8	10%	0.9	498	755	155	0	0	0	0	600	0	0	0
48	7.5	10%	0.8	427	785	185	0	0	0	0	600	0	0	0
49	4.4	10%	0.4	2480	2328	153	380	207	346	242	300	300	400	0
50	4.5	100%	4.5	2760	2293	255	315	0	0	0	1075	648	0	0

Catchment No.	Area (ha.)	PIMP	Impermeable Area (ha.)	Storage Required (m ³)	Total Volume Available (m ³)	Ref S.C _n .1	Ref S.C _n .2	Ref S.C _n .3	Ref S.C _n .4	Ref S.C _n .5	Ref P.C _n .1	Ref P.C _n .2	Ref P.C _n .3	Ref P.C _n .4
51	17.0	10%	1.7	1011	401	401	0	0	0	0	0	0	0	0
52	17.0	10%	1.7	1010	828	111	570	148	0	0	0	0	0	0

Sub-Annex D Greenfield Runoff Rates

Calculated by:	Chris Brandon
Site name:	Sunnica Energy Farm
Site location:	Chippenham/Worlington

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

Site Details

Latitude:	52.30907° N
Longitude:	0.46225° E
Reference:	2149007725
Date:	May 06 2021 08:57

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	1138
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Methodology

Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	1	1
HOST class:	N/A	N/A
SPR/SPRHOST:	0.1	0.1

Hydrological characteristics

	Default	Edited
SAAR (mm):	551	551
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is $Q_{\text{BAR}} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $\text{SPR/SPRHOST} \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	102.46	102.46
1 in 1 year (l/s):	89.14	89.14
1 in 30 years (l/s):	251.02	251.02
1 in 100 year (l/s):	364.74	364.74
1 in 200 years (l/s):	431.34	431.34

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Sub-Annex E Maintenance Schedules

Infiltration Basins

Infiltration basins are vegetated open surface basins designs to store water and allow it to infiltrate into the ground. Vegetation provides amenity benefit and filtration of pollutants and is therefore as important to its function as the basin itself. A schedule setting out the maintenance operations, actions and frequency is included below. Please also refer to the manufacturer's operation and maintenance manual for any inlet structures or valves if available.

CIRIA C753 TABLE 13.2 Operation and maintenance requirements for infiltration basins

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter, debris and trash	Monthly
	Cut grass – for landscaped areas 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
Occasional maintenance	Reseed areas of poor vegetation growth	Annually, or as required
	Prune and trim trees and remove cuttings	As required
	Remove sediment from pre-treatment system when 50% full	As required
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realign the rip-rap	As required
	Repair or rehabilitate inlets, outlets and overflows	As required
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	As required
	Relevel uneven surfaces and reinstate design levels	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly

Maintenance schedule	Required action	Typical frequency
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies	Half yearly
	Inspect infiltration surfaces for compaction and ponding	Monthly

Swales

Swales are man-made linear depressions designed to convey water along a specified route. Upkeep of swales and their inlets and outlets is key to their function.

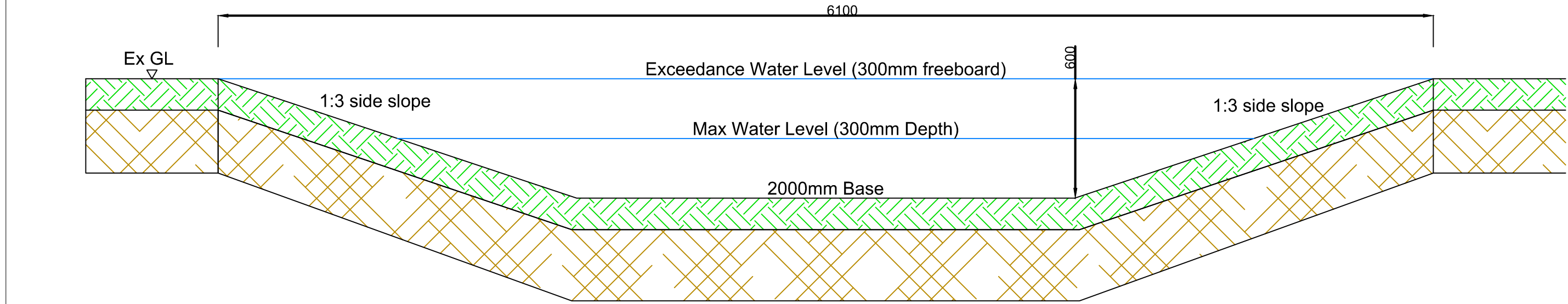
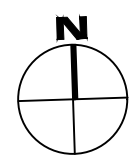
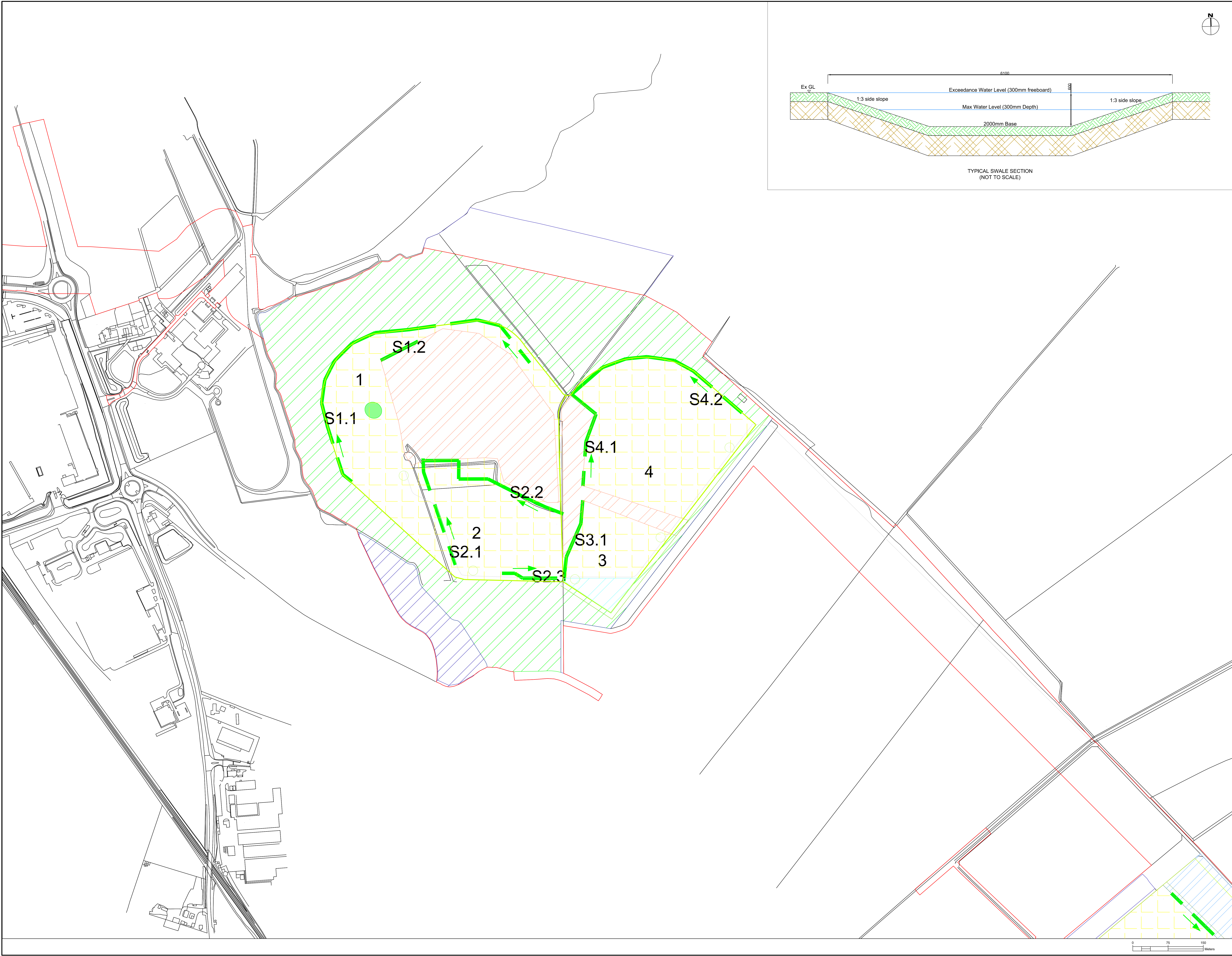
A schedule setting out the maintenance operations, actions and frequency is included below. Please also refer to the manufacturers operation and maintenance manual for any inlet structures if available.

CIRIA C753 TABLE 17.1 Operation and maintenance requirements for swales

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	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 infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half quarterly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly

Maintenance schedule	Required action	Typical frequency
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseedling	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
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Sub-Annex F Drainage General Arrangements



TYPICAL SWALE SECTION
(NOT TO SCALE)

AECOM

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6. DRAINAGE SWALES PROPOSED WITH INFILTRATION SUBJECT TO FURTHER ON SITE GROUND INVESTIGATIONS. NO PIPED DRAINAGE PROPOSED OTHER THAN OUTLETS TO WATERCOURSES WHERE REQUIRED.

7. HIGH LEVEL DRAINAGE ASSESSMENT IS BASED ON TOPOGRAPHICAL CATCHMENT RUNOFF CONTOUR MODEL AND NOT CURRENTLY BASED ON DETAILED RUNOFF RATES AND VOLUMES; THIS WILL BE PREPARED AT PLANNING STAGE AND SWALES ADJUSTED TO SUIT IF REQUIRED.

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KEY PLAN - WEST SIDE

KEY

LAYOUT

RED LINE BOUNDARY

SOLAR FIELD AREA

ARCHAEOLOGICAL MITIGATION AREA

ISSUE/REVISION

P5	19.10.21	BOUNDARY UPDATE
P4	09.07.21	BOUNDARY UPDATE
P3	02.09.20	BOUNDARY UPDATE
P2	03.08.20	BOUNDARY UPDATE
P1	04.10.19	PRELIMINARY
IR	DATE	DESCRIPTION

ISSUE PURPOSE / SUITABILITY

PROJECT NUMBER

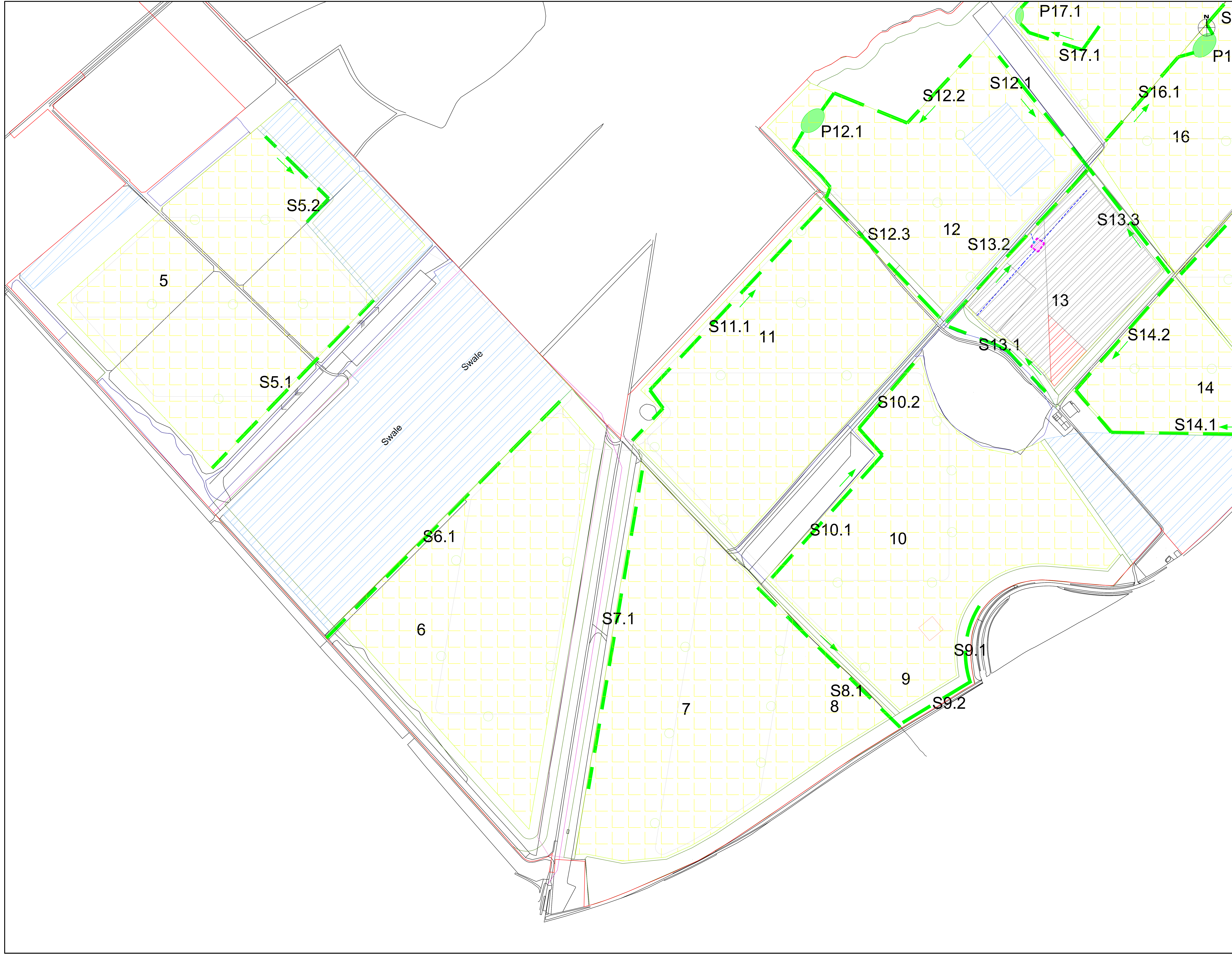
60589004

SHEET TITLE

SUNNICA ENERGY FARM
DRAINAGE STRATEGY
GENERAL ARRANGEMENT
WEST SITE (SHEET 1 OF 3)

SHEET NUMBER

WPP-ACM-XX-DR-C-ZZ-001



AECOM

PROJECT

sunnica

energy farm

CLIENT

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KEY PLAN - WEST SIDE

KEY

LAYOUT

RED LINE BOUNDARY

SOLAR FIELD AREA

ARCHAEOLOGICAL MITIGATION AREA

COMPOUND AREA (PERMANENT)

ECOLOGY ENHANCEMENT

ECOLOGY ENHANCEMENT WETLAND

RETAINED WOODLAND

BATTERY STORAGE / COMPOUND

SWALE (0.6m DEEP)

INFILTRATION BASIN (0.6m DEEP)

FIRE WATER STORAGE LAGOON WITH PENSTOCK

FIREWATER DRAINAGE ROUTE

ISSUE/REVISION		
P4	19.10.21	BOUNDARY UPDATE
P3	09.07.21	BOUNDARY DESIGN UPDATE
P2	03.08.20	BOUNDARY UPDATE
P1	04.10.19	PRELIMINARY
IR	DATE	DESCRIPTION

ISSUE PURPOSE / SUITABILITY

PROJECT NUMBER

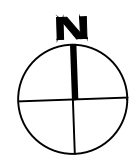
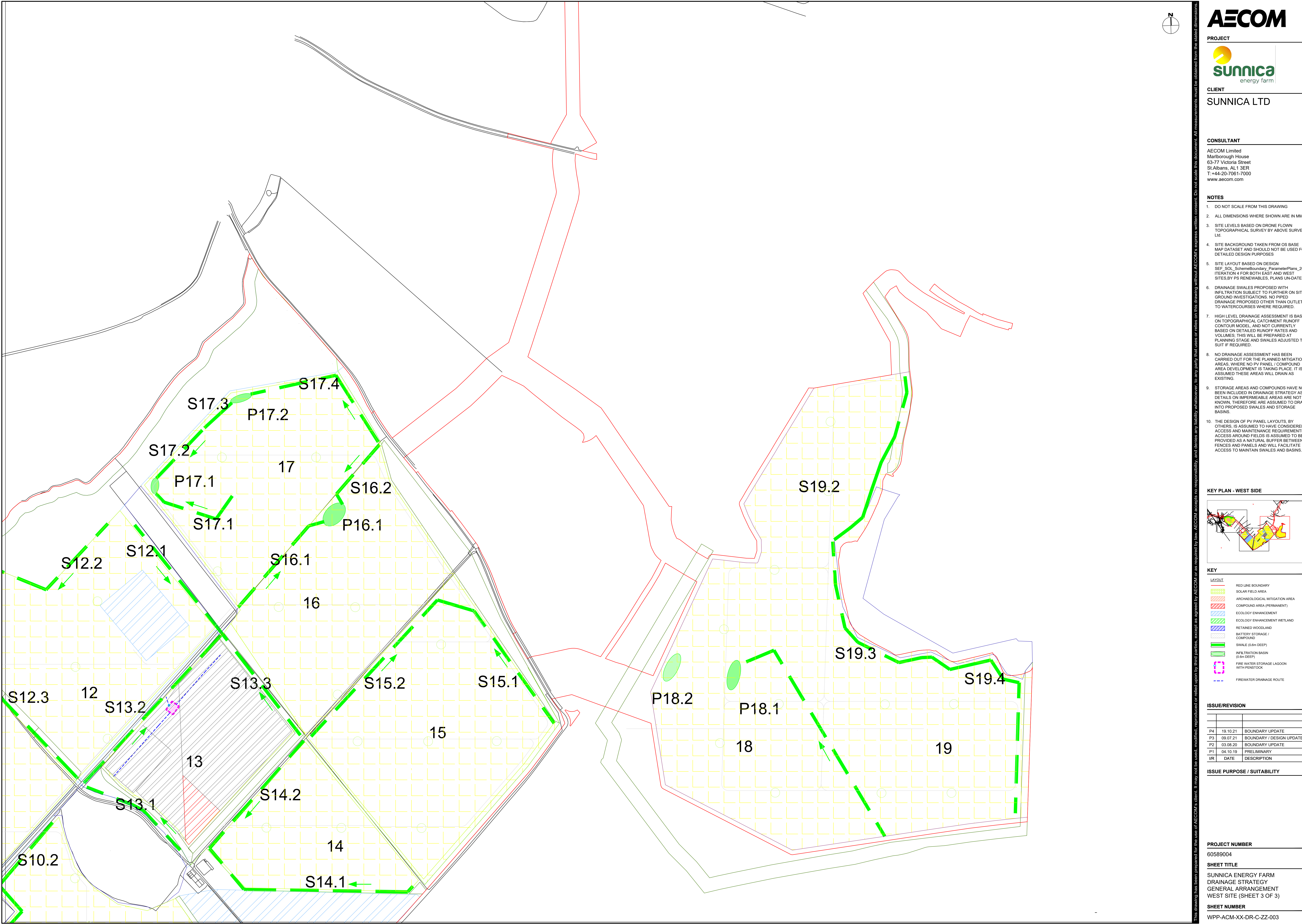
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SHEET TITLE

SUNNICA ENERGY FARM
DRAINAGE STRATEGY
GENERAL ARRANGEMENT
WEST SITE (SHEET 2 OF 3)

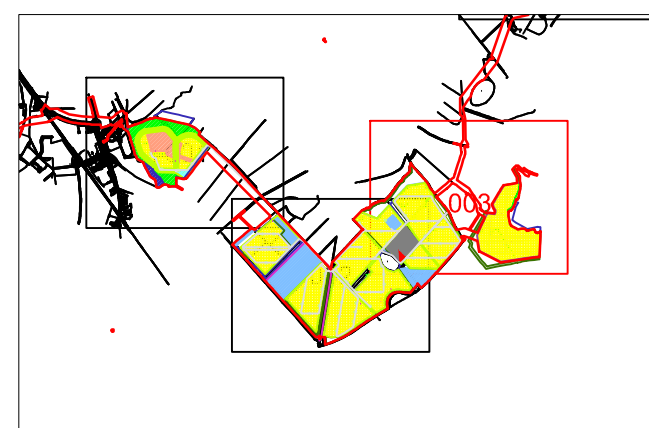
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KEY PLAN - WEST SIDE



KEY

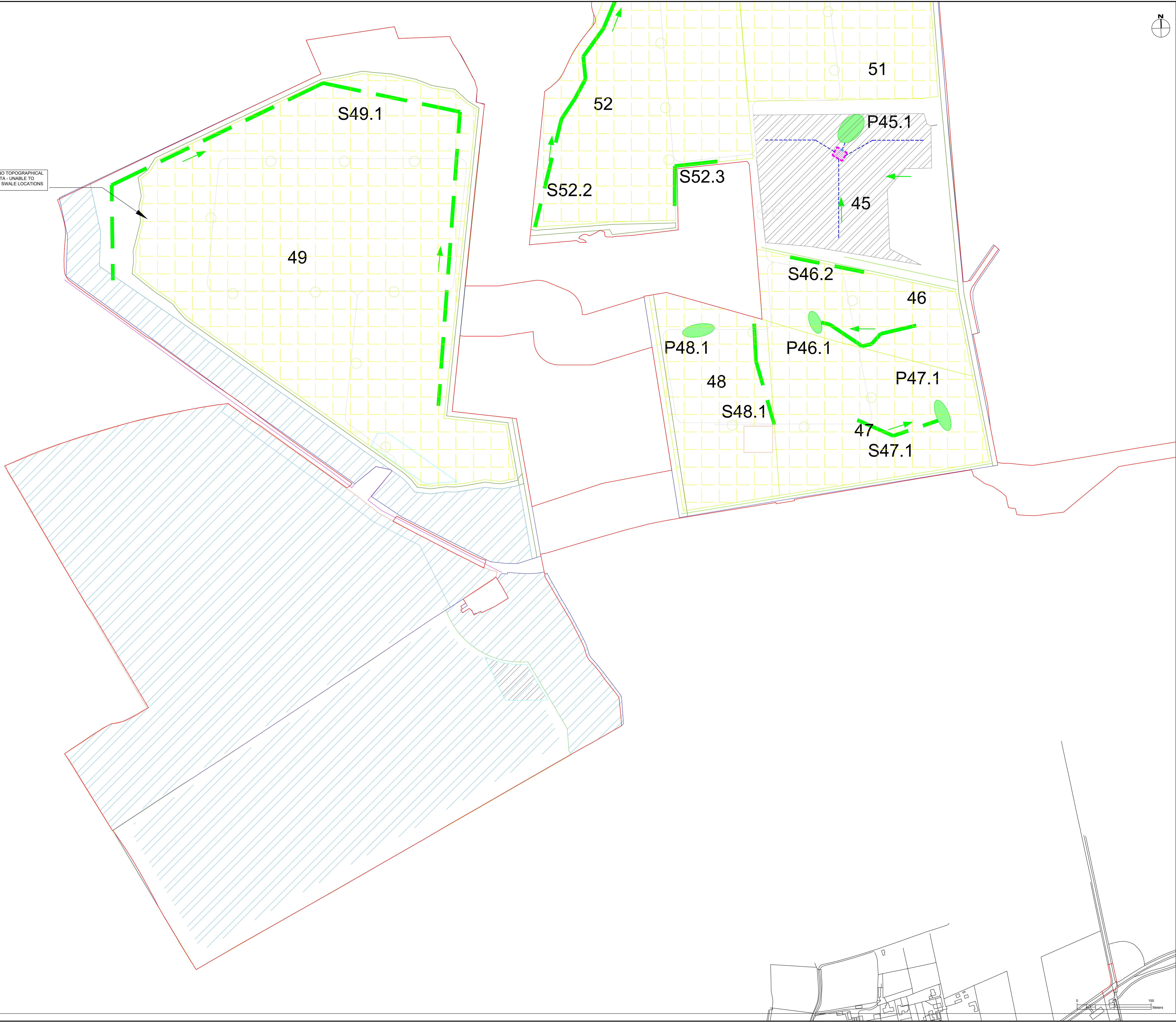
LAYOUT	
[Red outline]	RED LINE BOUNDARY
[Yellow grid]	SOLAR FIELD AREA
[Red hatched]	ARCHAEOLOGICAL MITIGATION AREA
[Blue hatched]	COMPOUND AREA (PERMANENT)
[Green hatched]	ECOLOGY ENHANCEMENT
[Blue hatched]	ECOLOGY ENHANCEMENT WETLAND
[Blue hatched]	RETAINED WOODLAND
[Blue hatched]	BATTERY STORAGE / COMPOUND
[Green line]	SWALE (0.6m DEEP)
[Green oval]	INFILTRATION BASIN (0.6m DEEP)
[Pink outline]	FIRE WATER STORAGE LAZARON WITH PENSTOCK
[Blue dashed line]	FIREWATER DRAINAGE ROUTE

ISSUE/REVISION

P4	19.10.21	BOUNDARY UPDATE
P3	09.07.21	BOUNDARY DESIGN UPDATE
P2	03.08.20	BOUNDARY UPDATE
P1	04.10.19	PRELIMINARY
IR	DATE	DESCRIPTION

ISSUE PURPOSE / SUITABILITY

AREA HAS NO TOPOGRAPHICAL
SURVEY DATA - UNABLE TO
DETERMINE SWALE LOCATIONS



AECOM

PROJECT

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KEY PLAN - EAST SIDE

KEY

LAYOUT

RED LINE BOUNDARY

SOLAR FIELD AREA

ARCHAEOLOGICAL MITIGATION AREA

COMPOUND AREA (PERMANENT)

ECOLOGY ENHANCEMENT

ECOLOGY ENHANCEMENT WETLAND

RETAINED WOODLAND

BATTERY STORAGE / COMPOUND

SWALE (0.6m DEEP)

INFILTRATION BASIN (0.6m DEEP)

FIRE WATER STORAGE LAGOON WITH PENSTOCK

FIREWATER DRAINAGE ROUTE

ISSUE/REVISION

P4	19.10.21	BOUNDARY UPDATE
P3	09.07.21	BOUNDARY DESIGN UPDATE
P2	03.08.20	BOUNDARY UPDATE
P1	04.10.19	PRELIMINARY
IR	DATE	DESCRIPTION

ISSUE PURPOSE / SUITABILITY

PROJECT NUMBER

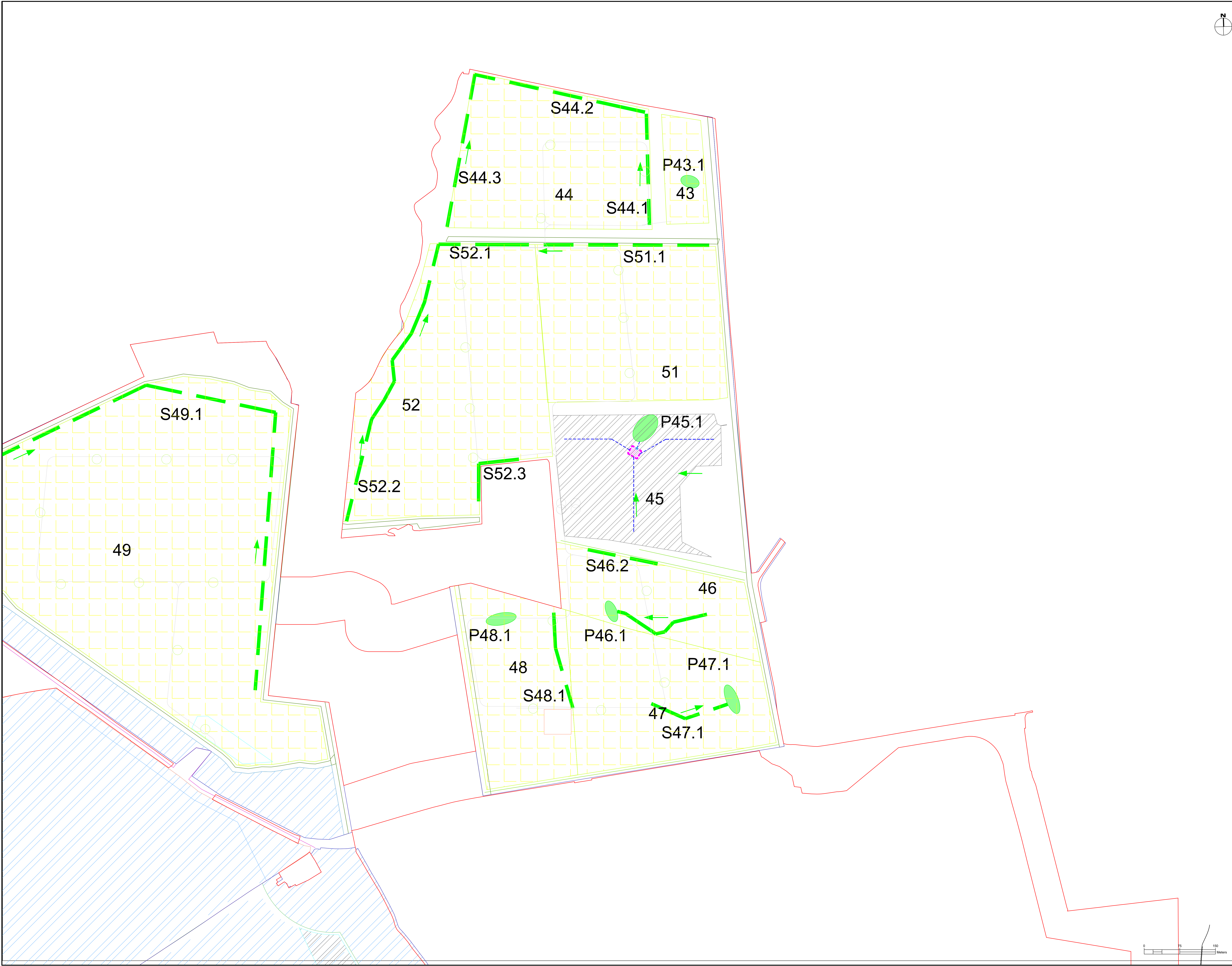
60589004

SHEET TITLE

SUNNICA ENERGY FARM
DRAINAGE STRATEGY
GENERAL ARRANGEMENT
EAST SITE (SHEET 1 OF 5)

SHEET NUMBER

WPP-ACM-XX-DR-CZ-ZZ-004



NOTES

- DO NOT SCALE FROM THIS DRAWING
- ALL DIMENSIONS WHERE SHOWN ARE IN MM.
- SITE LEVELS BASED ON DRONE FLOWN TOPOGRAPHICAL SURVEY BY ABOVE SURVEYS Ltd.
- SITE BACKGROUND TAKEN FROM OS BASE MAP DATASET AND SHOULD NOT BE USED FOR DETAILED DESIGN PURPOSES
- SITE LAYOUT BASED ON DESIGN SEF, SOL, SchemeBoundary, ParameterPlans_200715 ITERATION 4 FOR BOTH EAST AND WEST SITES BY PS RENEWABLES, PLANS UN-DATED.
- DRAINAGE SWALES PROPOSED WITH INFILTRATION SUBJECT TO FURTHER ON SITE GROUND INVESTIGATIONS. NO PIPED DRAINAGE PROPOSED OTHER THAN OUTLETS TO WATERCOURSES WHERE REQUIRED.
- HIGH LEVEL DRAINAGE ASSESSMENT IS BASED ON TOPOGRAPHICAL CATCHMENT RUNOFF CONTOUR MODEL, AND NOT CURRENTLY BASED ON DETAILED RUNOFF RATES AND VOLUMES; THIS WILL BE PREPARED AT PLANNING STAGE AND SWALES ADJUSTED TO SUIT IF REQUIRED.
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KEY PLAN - EAST SIDE



KEY

- | LAYOUT | |
|---|--|
| RED LINE BOUNDARY | |
| SOLAR FIELD AREA | |
| ARCHAEOLOGICAL MITIGATION AREA | |
| COMPOUND AREA (PERMANENT) | |
| ECOLOGY ENHANCEMENT | |
| ECOLOGY ENHANCEMENT WETLAND | |
| RETAINED WOODLAND | |
| BATTERY STORAGE / COMPOUND | |
| SWALE (0.6m DEEP) | |
| INFILTRATION BASIN (0.6m DEEP) | |
| FIRE WATER STORAGE LAGOON WITH PENSTOCK | |
| FRESHWATER DRAINAGE ROUTE | |

ISSUE/REVISION

NO	DATE	DESCRIPTION
P4	19.10.21	BOUNDARY UPDATE
P3	09.07.21	BOUNDARY DESIGN UPDATE
P2	03.08.20	BOUNDARY UPDATE
P1	04.10.19	PRELIMINARY
IR	DATE	DESCRIPTION

ISSUE PURPOSE / SUITABILITY

PROJECT NUMBER

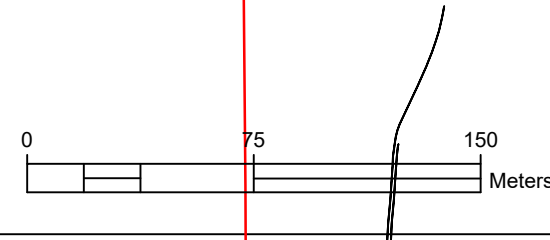
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SHEET TITLE

SUNNICA ENERGY FARM
DRAINAGE STRATEGY
GENERAL ARRANGEMENT
EAST SITE (SHEET 2 OF 5)

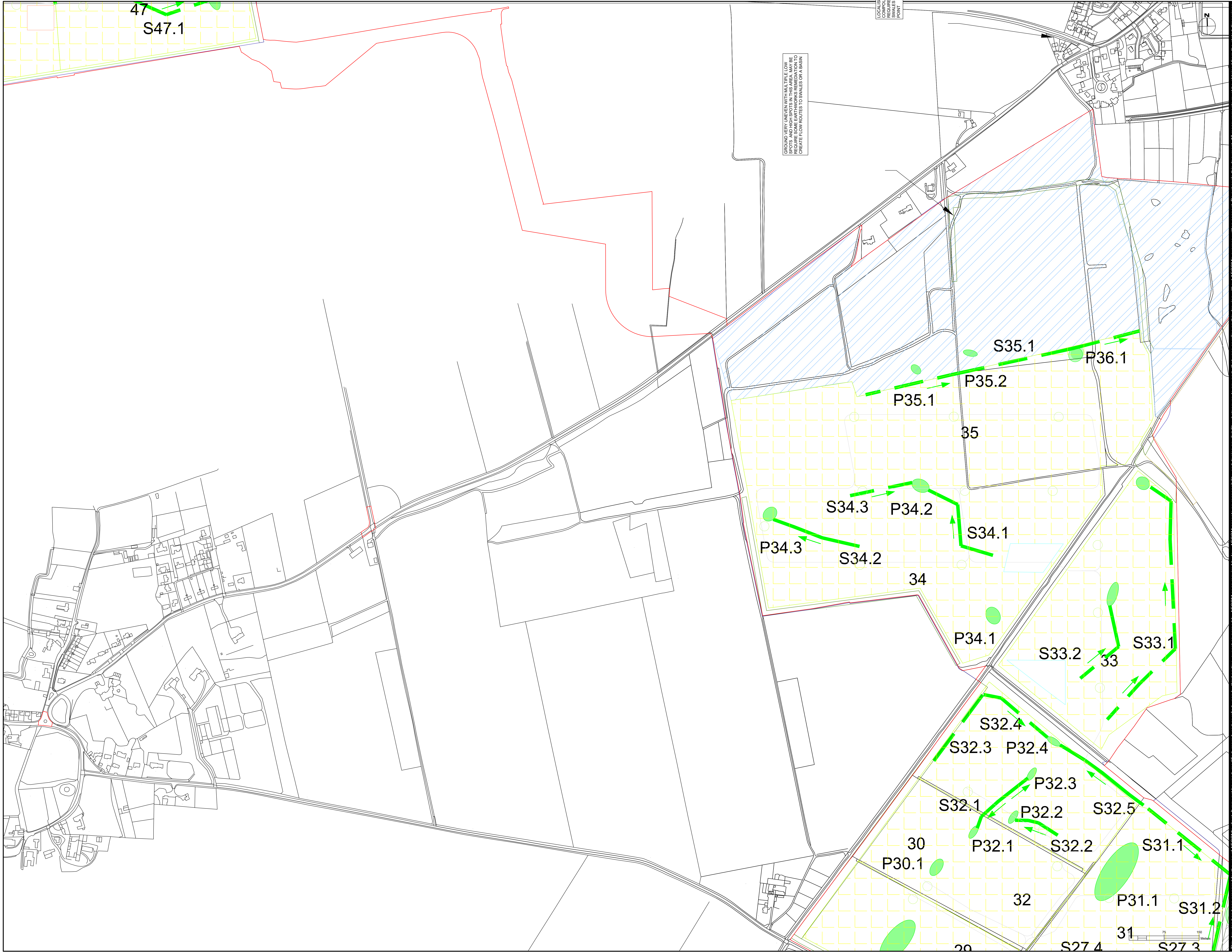
SHEET NUMBER

WPP-ACM-XX-DR-C-ZZ-005



ISO A0 841mm x 1189mm
Drawn CD
Approved: NC
Checked: CS
Designer: AR
Project Management Initials: x01.1
Revision:

Last saved by: CHRISTOPHER BRANDON(2021-10-19) Last Plotted: 2021-10-19
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PROJECT

CLIENT

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www.aecom.com

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6. DRAINAGE SWALES PROPOSED WITH INFILTRATION SUBJECT TO FURTHER ON SITE GROUND INVESTIGATIONS. NO PIPED DRAINAGE PROPOSED OTHER THAN OUTLETS TO WATERCOURSES WHERE REQUIRED.

7. HIGH LEVEL DRAINAGE ASSESSMENT IS BASED ON TOPOGRAPHICAL CATCHMENT RUNOFF CONTOUR MODEL AND NOT CURRENTLY BASED ON DETAILED RUNOFF RATES AND VOLUMES. THIS WILL BE PREPARED AT PLANNING STAGE AND SWALES ADJUSTED TO SUIT IF REQUIRED.

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KEY PLAN - EAST SIDE

KEY

LAYOUT

SOLAR FIELD AREA

RED LINE BOUNDARY

ARCHAEOLOGICAL MITIGATION AREA

COMPOUND AREA (PERMANENT)

ECOLOGY ENHANCEMENT

ECOLOGY ENHANCEMENT WETLAND

RETAINED WOODLAND

BATTERY STORAGE / COMPOUND

SWALE (0.6m DEEP)

INFILTRATION BASIN (0.6m DEEP)

FIRE WATER STORAGE LAGOON WITH PENSTOCK

FIREWATER DRAINAGE ROUTE

ISSUE/REVISION

P4	19.10.21	BOUNDARY UPDATE
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ISSUE PURPOSE / SUITABILITY

PROJECT NUMBER

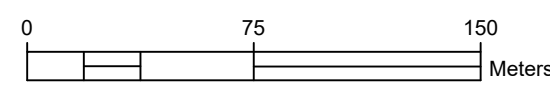
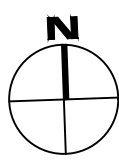
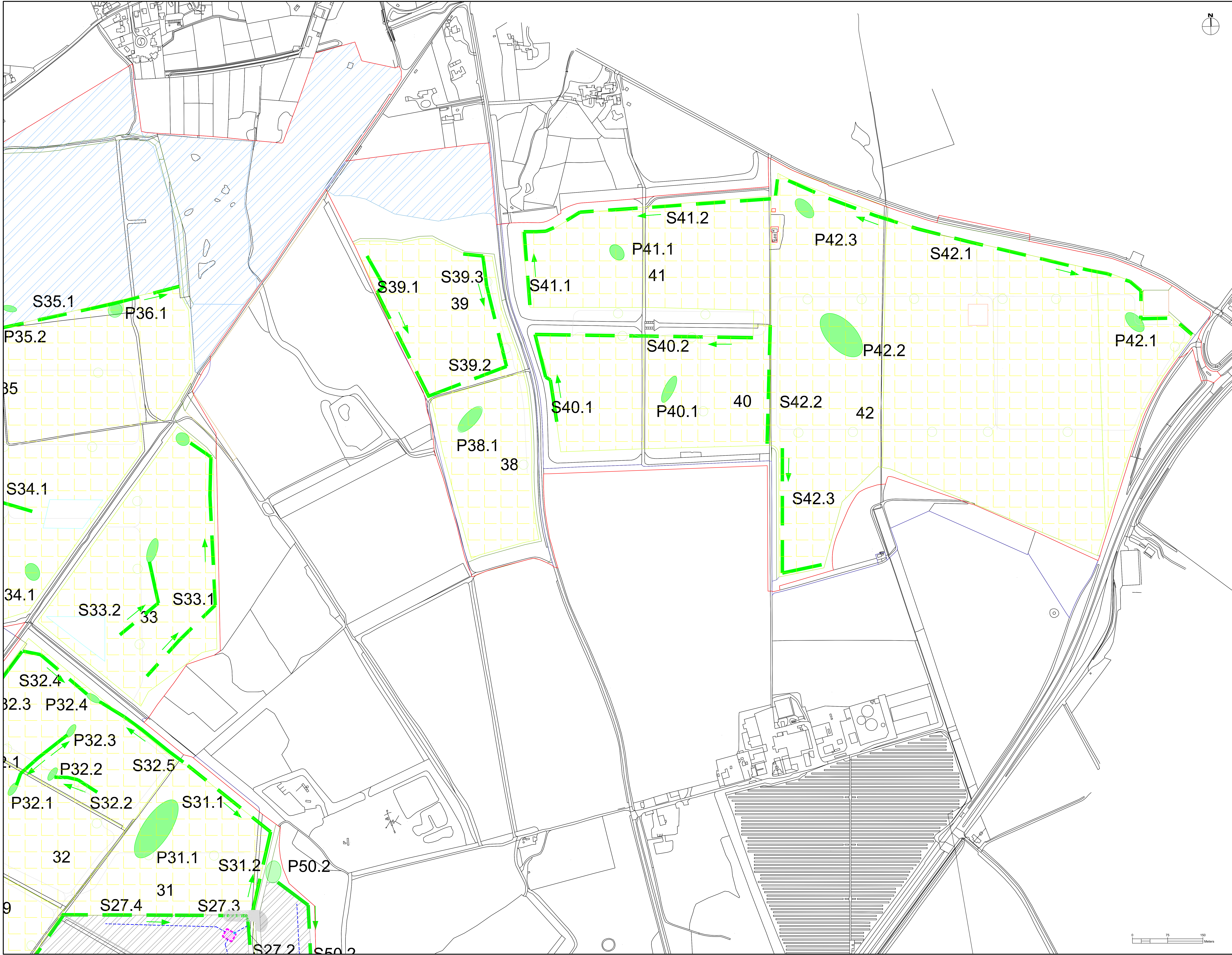
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SHEET TITLE

SUNNICA ENERGY FARM
DRAINAGE STRATEGY
GENERAL ARRANGEMENT
EAST SITE (SHEET 3 OF 5)

SHEET NUMBER

WPP-ACM-XX-DR-C-ZZ-006

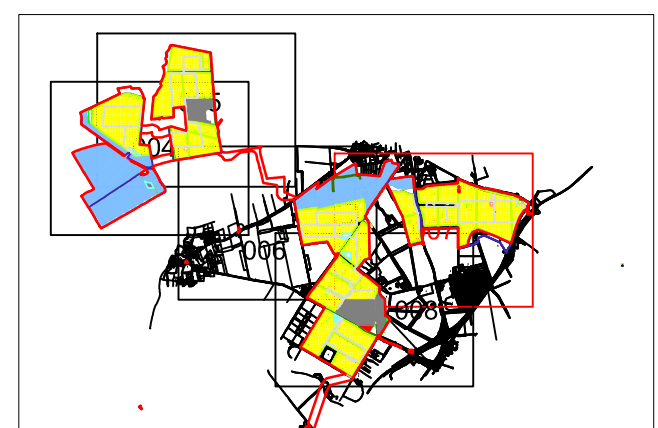


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KEY PLAN - EAST SIDE



- KEY PLAN**
- LAYOUT**
- RED LINE BOUNDARY
 - SOLAR FIELD AREA
 - ARCHAEOLOGICAL MITIGATION AREA
 - COMPOUND AREA (PERMANENT)
 - ECOLOGY ENHANCEMENT
 - ECOLOGY ENHANCEMENT WETLAND
 - RETAINED WOODLAND
 - BATTERY STORAGE / COMPOUND
 - SWALE (0.6m DEEP)
 - INFILTRATION BASIN (0.6m DEEP)
 - FINE WATER STORAGE LAGOON WITH PENSTOCK
 - FIREWATER DRAINAGE ROUTE

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ISSUE PURPOSE / SUITABILITY

PROJECT NUMBER

60589004

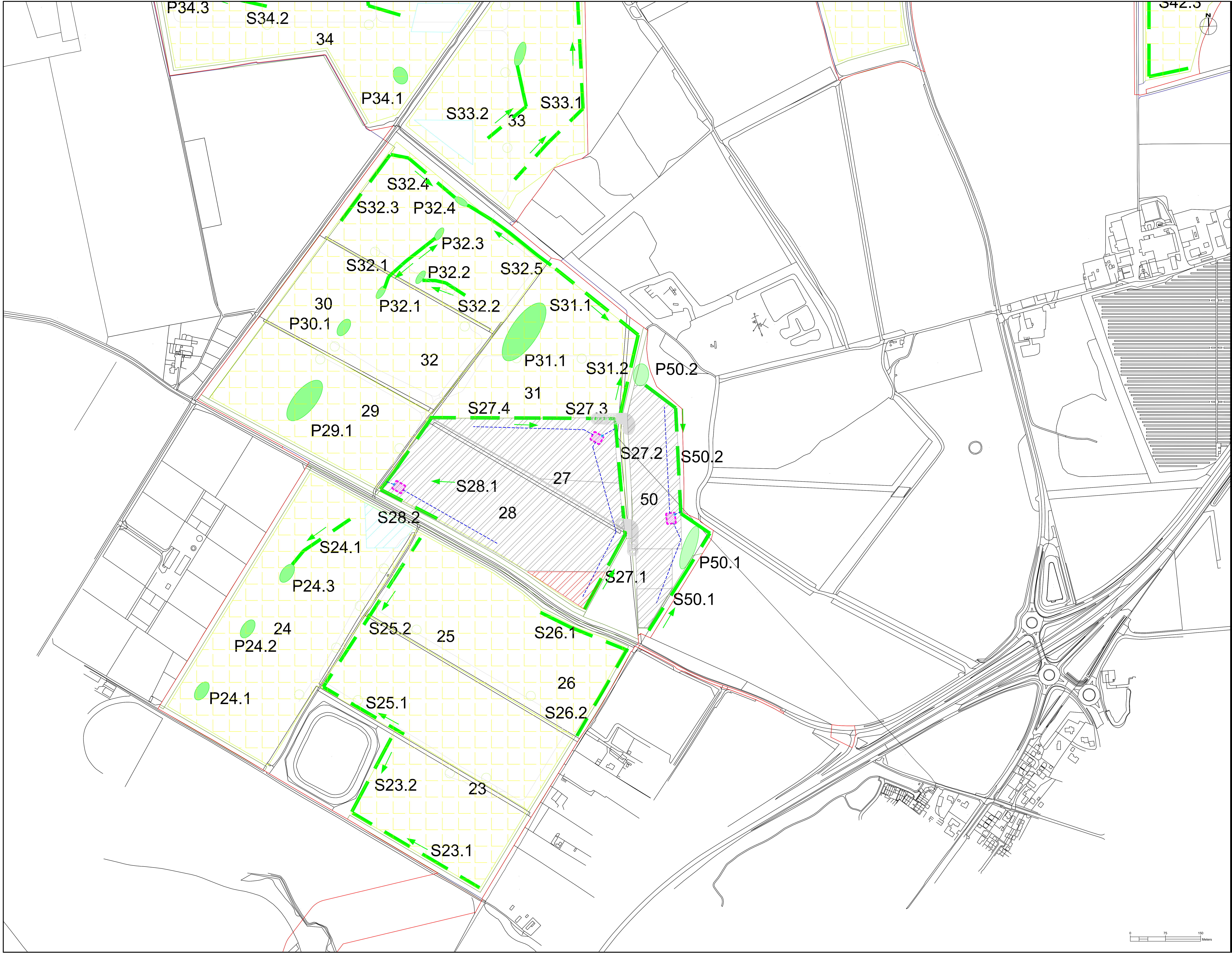
SHEET TITLE

SUNNICA ENERGY FARM
DRAINAGE STRATEGY
GENERAL ARRANGEMENT
EAST SITE (SHEET 4 OF 5)

SHEET NUMBER

WPP-ACM-XX-DR-C-ZZ-007

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KEY PLAN - EAST SIDE



KEY PLAN

- LEGEND**
- RED LINE BOUNDARY
 - SOLAR FIELD AREA
 - ARCHAEOLOGICAL MITIGATION AREA
 - COMPOUND AREA (PERMANENT)
 - ECOLOGY ENHANCEMENT
 - ECOLOGY ENHANCEMENT WETLAND
 - RETAINED WOODLAND
 - BATTERY STORAGE / COMPOUND
 - SWALE (0.6m DEEP)
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