



# ARCUS

**FLOOD RISK ASSESSMENT**

**ALDEBY SOLAR PARK**

**MARCH 2021**



Prepared By:

**Arcus Consultancy Services**

1C Swinegate Court East  
3 Swinegate  
York  
North Yorkshire  
YO1 8AJ

**T** +44 (0)1904 715 470 | **E** info@arcusconsulting.co.uk  
**W** [www.arcusconsulting.co.uk](http://www.arcusconsulting.co.uk)

Registered in England & Wales No. 5644976

Author	Reagan Duff	BA (hons) GradCIWEM	Flood Risk Consultant	29/03/2021
Reviewed	Liam Nevins	BSc (hons) MCIWEM C.WEM	Principal Hydrologist	29/03/2021

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	Background .....	1
1.2	Site Characteristics .....	1
1.2.1	Site Location .....	1
1.2.2	Surrounding Hydrological Network.....	2
1.2.3	Site Elevations.....	2
1.2.4	Flood Zone Categorisation.....	2
<b>2</b>	<b>FLOOD RISK ASSESSMENT .....</b>	<b>3</b>
2.1	Methodology .....	3
2.2	Fluvial Flood Risk .....	3
2.3	Pluvial Flood Risk .....	3
2.4	Tidal Flood Risk .....	4
2.5	Groundwater Flood Risk .....	4
2.6	Reservoir Flood Risk.....	5
2.7	Historical Flooding .....	5
<b>3</b>	<b>SURFACE WATER RUNOFF.....</b>	<b>5</b>
<b>4</b>	<b>NPPF SEQUENTIAL AND EXCEPTION TEST .....</b>	<b>6</b>
4.1	Sequential Test .....	6
4.2	Exception Test.....	6
<b>5</b>	<b>MITIGATION .....</b>	<b>7</b>
<b>6</b>	<b>CONCLUSION .....</b>	<b>7</b>

### APPENDIX A – SITE LAYOUT

### APPENDIX B – TOPOGRAPHIC SURVEY

## 1 INTRODUCTION

### 1.1 Background

Arcus Consultancy Services Ltd (Arcus) has been commissioned by Infinis Solar Developments Ltd (the Applicant) to undertake a Flood Risk Assessment (FRA) in relation to the proposed Aldeby Solar Park (hereafter known as 'the Development'), located on the closed Aldeby landfill site located approximately 1.2 km to the southeast of Aldeby and 400 m south of Burgh St Peter ('the Site') in Norfolk.

This FRA is intended to meet the requirements of the:

- Environment Agency (EA);
- South Norfolk District Council Strategic Flood Risk Assessment (SFRA)<sup>1</sup>;
- South Norfolk District Council Preliminary Flood Risk Assessment (PFRA)<sup>2</sup>;
- Norfolk County Council Flood Risk Management Strategy<sup>3</sup>; and
- Revised National Planning Policy Framework (NPPF)<sup>4</sup>.

The Site Layout Plan can be found in Appendix A of this Report.

### 1.2 Site Characteristics

#### 1.2.1 Site Location

The Development is located on the closed Aldeby Landfill site situated off Common Road, Aldeby, centred on National Grid Reference TM 46609 92690, as shown in Plate 1.

---

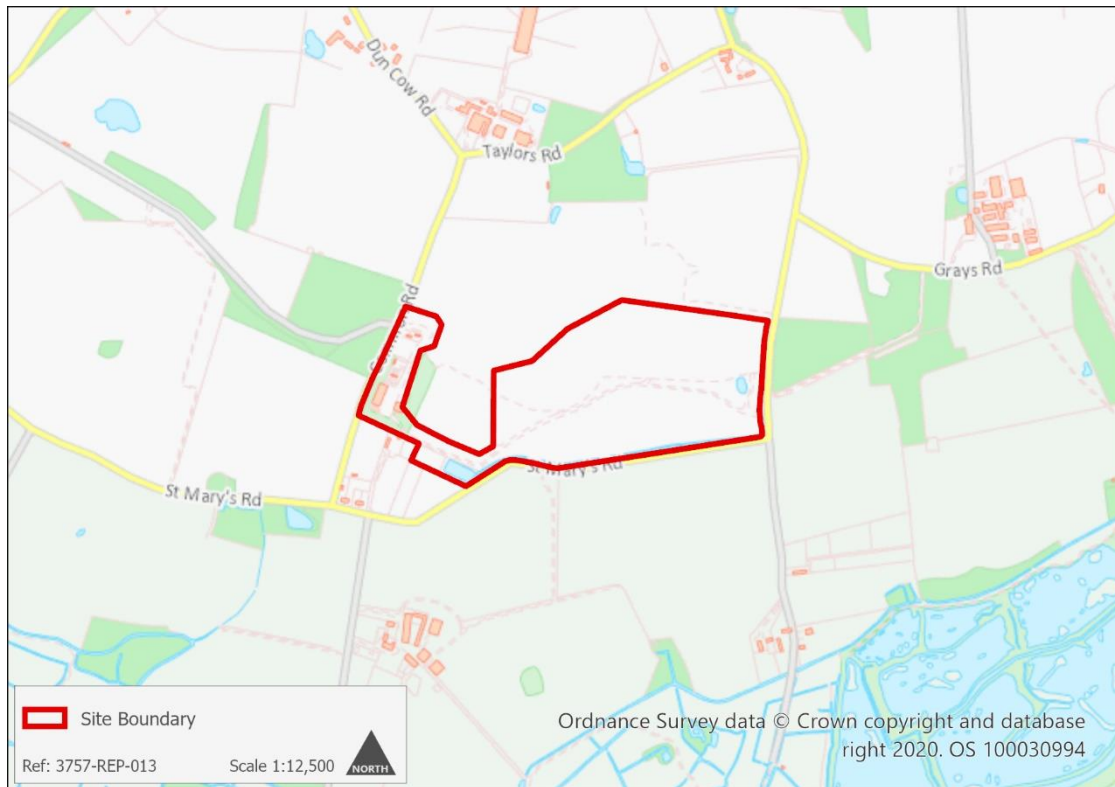
<sup>1</sup> South Norfolk Council, SFRA (2017). [Online]. Available at: [https://gnlp.oc2.uk/docfiles/14/2017s5962\\_greater\\_norwich\\_area\\_sfra\\_final\\_v2.0.pdf](https://gnlp.oc2.uk/docfiles/14/2017s5962_greater_norwich_area_sfra_final_v2.0.pdf)

<sup>2</sup> South Norfolk Council, PFRA (2011). [Online]. Available at: <https://www.norfolk.gov.uk/-/media/norfolk/downloads/what-we-do-and-how-we-work/policy-performance-and-partnerships/policies-and-strategies/flood-and-water-management/preliminary-flood-risk-assessment-report.pdf?la=en>

<sup>3</sup> Norfolk County Council, Local Flood Risk Strategy. [Online]. Available at: <https://www.norfolk.gov.uk/what-we-do-and-how-we-work/policy-performance-and-partnerships/policies-and-strategies/flood-and-water-management-policies/local-flood-risk-management-strategy>

<sup>4</sup> Ministry of Housing, Communities & Local Government (2019). "Revised National Planning Policy Framework" [online] Available at: <https://www.gov.uk/government/collections/revised-national-planning-policy-framework>.

### **Plate 1: Site Location**



#### **1.2.2 Surrounding Hydrological Network**

A land drain is located to the south of the Site, flowing in a westerly direction before discharging into an attenuation lagoon to the south west.

The River Waveney is located approximately 685 m south of the Site, with a confluence with the Great River Ouse approximately 13 km north of the Site.

The Site is not shown to be located within the operational boundary of an Internal Drainage Board (IDB)<sup>5</sup>.

#### **1.2.3 Site Elevations**

A Topographic Survey of the Site has been conducted and can be found in Appendix B of this report. This report indicates that general Site topography falls north to south, with elevations ranging from approximately 13 metres Above Ordnance Datum (m AOD) to 29 m AOD.

#### **1.2.4 Flood Zone Categorisation**

The Environment Agency (EA) Flood Map for Planning<sup>6</sup> shows that the Development infrastructure is located entirely within Flood Zone (FZ) 1, an area described as "low probability" of flooding in Table 1: Flood Zones of the "Planning Practice Guidance to the National Planning Policy Framework"<sup>7</sup>. This zone is categorised as being the lowest flood risk and comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding in any year.

<sup>5</sup> Association of Drainage Authorities, Internal Drainage Boards Map. [Online]. Available at: <https://www.ada.org.uk/idb-map/>

<sup>6</sup>The EA Flood Map for Planning. [Online] Available at: <https://flood-map-for-planning.service.gov.uk/summary/450582/439435>.

<sup>7</sup> Department for Communities and Local Government (DCLG) (2014). "Planning Practice Guidance". [Online] Available at: <http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/>.

## 2 Flood Risk Assessment

As the Development site is greater than 1 hectare (ha) in area, a Flood Risk Assessment has been undertaken in accordance with footnote 50 of the revised NPPF.

### 2.1 Methodology

Flood risk will be classed as Negligible (where little or no risk is identified), Low (where theoretical risk is identified but mitigating factors may influence flood levels) or Moderate to High (where modelled levels or historical events show risk to the Site).

Several factors will be taken into account when attributing the residual risk of flooding to the Site, including:

- Depth of flooding;
- Flooding extent / ingress into site;
- Type of infrastructure affected; and
- Intervening structures / flood protection.

A residual risk table is provided in the conclusion of this FRA and will provide comment and justification for the risk category using professional judgement and experience of assessing similar types of scenarios.

### 2.2 Fluvial Flood Risk

The EA Long Term Flood Risk Maps indicate that the Site is considered to be at 'Very Low' risk of fluvial flooding, defined as an area with a chance of flooding of less than 0.1%.

As discussed in Section 1.2.2, overland drainage is located to the south of the Site, discharging into an attenuation pond to the south west of the Site. The EA Risk of Flooding from Surface Water Map indicates there are no flood waters at the Site which emanate from the drainage network.

Acknowledging the Flood Zone 1 categorisation and 'Very Low' definition, the fluvial flood risk at the site is considered to be Negligible.

### 2.3 Pluvial Flood Risk

The Environment Agency defines surface water flooding as follows:

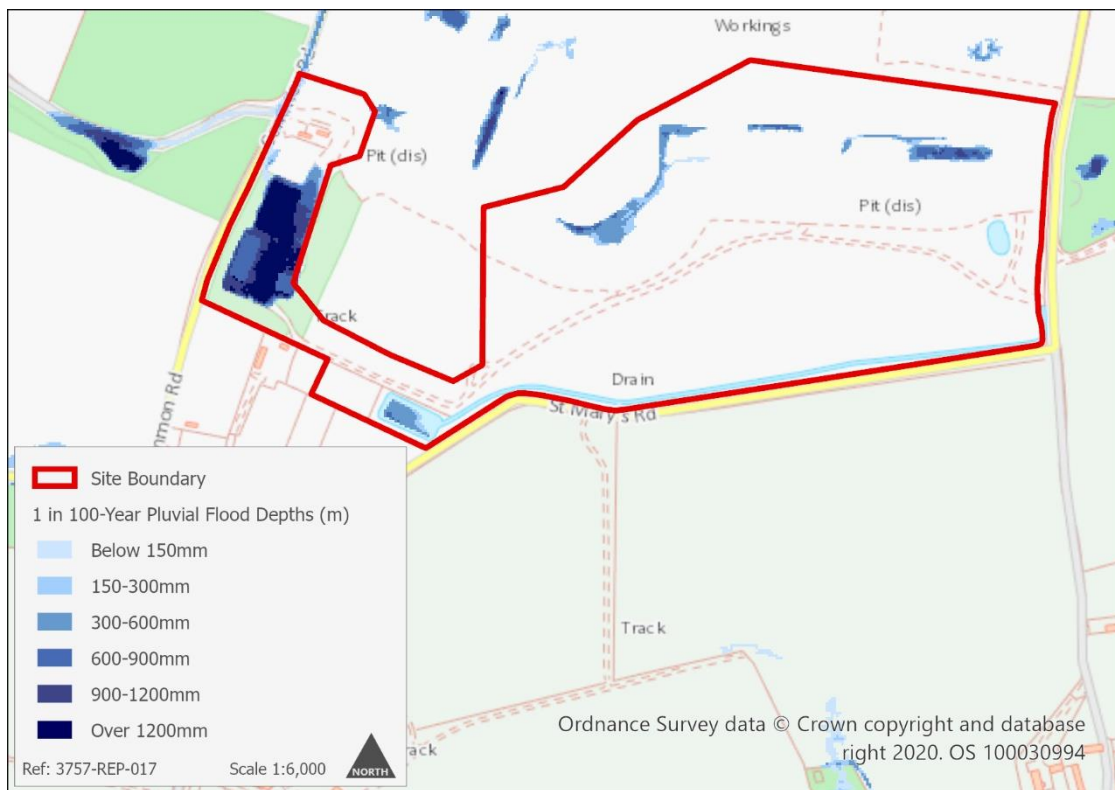
*"A surface water flood event that results from rainfall generated overland flow before the runoff enters any watercourse or sewer. Usually associated with high intensity rainfall (typically >30mm/hr) resulting in overland flow and ponding in depressions in the topography, but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen, developed or otherwise has low permeability. Urban underground sewerage/drainage systems and surface watercourses may be completely overwhelmed, preventing drainage. Surface water flooding does not include sewer surcharge in isolation."*

As such, surface water flooding can occur in most places when precipitation events are heavy enough for the local topography and circumstances to be unable to absorb the rainfall.

High rainfall/local groundwater levels leading to the ponding of water in low-lying areas. This type of flooding can often occur seasonally to agricultural land. In fenland areas the pumped drainage system is designed to remove this excess water, but in particularly wet periods it may not be able to cope, leading to waterlogging or surface water flooding.

The EA Risk of Flooding from Surface Water Map indicates that during the 'medium' risk 1:100-year pluvial event the proposed access track to the west of the Site is at risk of pluvial flooding to maximum depths of 1.2 m, with isolated areas to the north of the Site at risk of flooding to depths limited to 900 mm, as shown in Plate 2.

**Plate 2: 1 in 100-Year Pluvial Flood Depths**



The areas of pluvial flood risk are associated with Site elevations, with any sensitive infrastructure located in an area with no modelled pluvial depths, as shown in Appendix A.

The isolated areas of pluvial flooding to maximum depths of 900 mm are shown to comprise of PV arrays. The electrical connections on the PV arrays will be located on the upper edge of the panels and therefore well above ground level and would still function should areas of the Site be under water following an extreme rainfall event.

The onsite pluvial flood risk will be mitigated through the implementation of a surface water drainage regime, discussed further in Section 3 of this report.

Acknowledging the limited pluvial depths at the Site and location of any sensitive infrastructure outside of modelled pluvial flood risk areas, the surface water flood risk is considered Low.

## 2.4 Tidal Flood Risk

The Site is located within Flood Zone 1, with the EA Flood Risk from Rivers or the Sea Map indicating the site is not at risk of tidal flooding.

As such, the onsite tidal flood risk is considered Negligible.

## 2.5 Groundwater Flood Risk

A Borehole record located within the Site shows that clay and gravel stratum overlain by sand is present to depths of 36 m<sup>8</sup>.

Given the low permeability of bedrock at the Site, flooding of the Development as a result of groundwater fluctuations is considered unlikely and the risk is considered to be Negligible.

<sup>8</sup> British Geological Survey, Borehole Scan, Node TM49SE14. [Online]. Available at: [http://scans.bgs.ac.uk/sobi\\_scans/boreholes/543081/images/12148696.html](http://scans.bgs.ac.uk/sobi_scans/boreholes/543081/images/12148696.html)



## 2.6 Reservoir Flood Risk

The EA Flood Risk from Reservoirs Map<sup>9</sup> shows that the Site is not located in an area modelled to be at risk of flooding from reservoirs.

Therefore, the risk of the Development flooding from reservoirs is considered to be Negligible.

## 2.7 Historical Flooding

The EA Flood Risk from Historic Flood Map<sup>10</sup> shows that the Site is not located in an area with previous flooding history.

## 3 SURFACE WATER RUNOFF

The Site is greenfield and appears to be relatively well drained by clay dominated soils.

The Development will utilise the network of existing agricultural tracks where possible, limiting the requirement for new hardstanding.

The Type 2 aggregate used for any new access tracks will be permeable, as shown in Plate 3.

***Plate 3: Typical Type 2 aggregate at a solar farm***



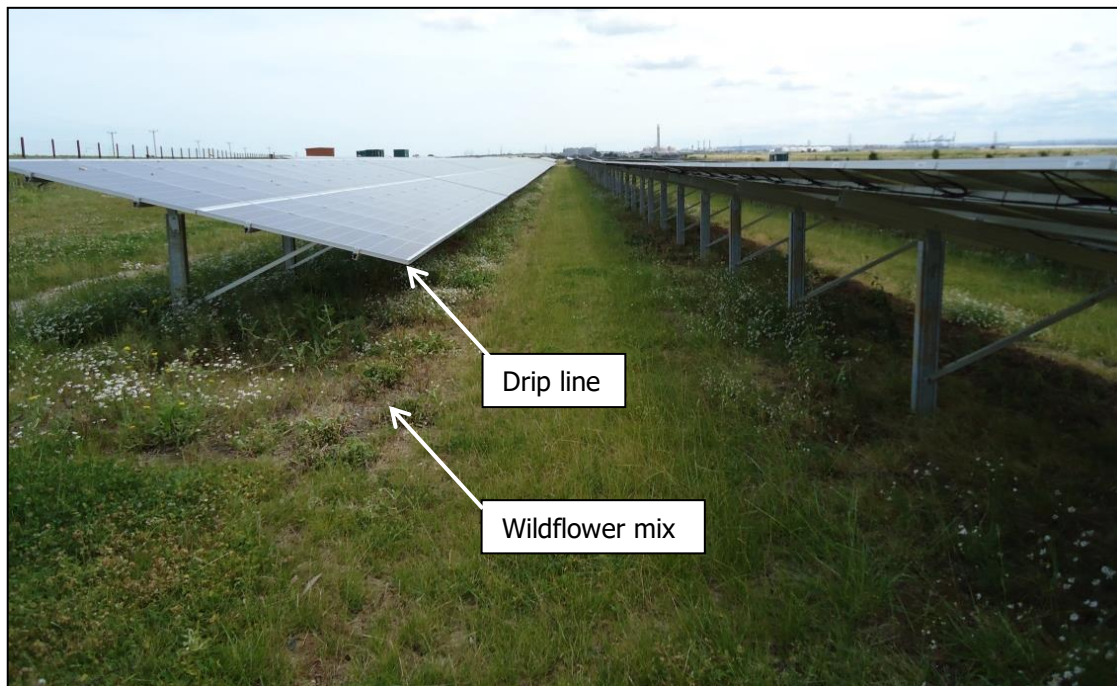
The PV arrays have the potential to concentrate rainfall under the drip line. As such, the area under the drip line should be seeded with a suitable grass / flower mix, as shown in Plate 4, to prevent rilling and an increase in surface water run-off rates.

<sup>9</sup> Environment Agency, Flooding from Reservoirs Map. [Online]. Available at: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>.

<sup>10</sup> Environment Agency, Historic Flood Map. [Online]. Available at: <https://data.gov.uk/dataset/76292bec-7d8b-43e8-9c98-02734fd89c81/historic-flood-map>



**Plate 4: Established wildflower mix under PV drip line**



With the implementation of suitable planting (such as a wildflower mix) the ground cover is unlikely to generate surface water runoff rates beyond the baseline scenario.

During an Arcus site walkover existing an existing perimeter swale was identified serving the Site, which will be retained and is considered to intercept surface water runoff emanating from the Site.

Once operational as a Solar Park, surface water will be defined and appropriately managed through the implementation of a drainage strategy the details of which could be adequately secured by an appropriately worded planning condition.

## **4 NPPF SEQUENTIAL AND EXCEPTION TEST**

### **4.1 Sequential Test**

The site is located within Flood Zone 1 and is therefore considered to satisfy the criteria of the NPPF Sequential Test.

### **4.2 Exception Test**

The Planning Practice Guidance to the NPPF states that the two criteria set out in the Exception Test should be applied to developments. The two criteria are listed below:

1. It must be demonstrated that the Development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment; and
2. A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Acknowledging the primary function of the Development is to produce green energy for the export to the grid and the Flood Zone 1 categorisation, the site and this Flood Risk Assessment is considered to satisfy the requirements of the Exception Test.

## **5 MITIGATION**

Acknowledging the negligible flood risk at the Site mitigation measures are not deemed necessary nor appropriate.

## **6 CONCLUSION**

This report has been written to meet the requirements of the NPPF and the EA.

The Development is located in Flood Zone 1, an area described as “low probability” categorised as being the lowest flood risk and comprises land assessed as having a less than 1:1,000 annual probability of river or sea flooding in any year.

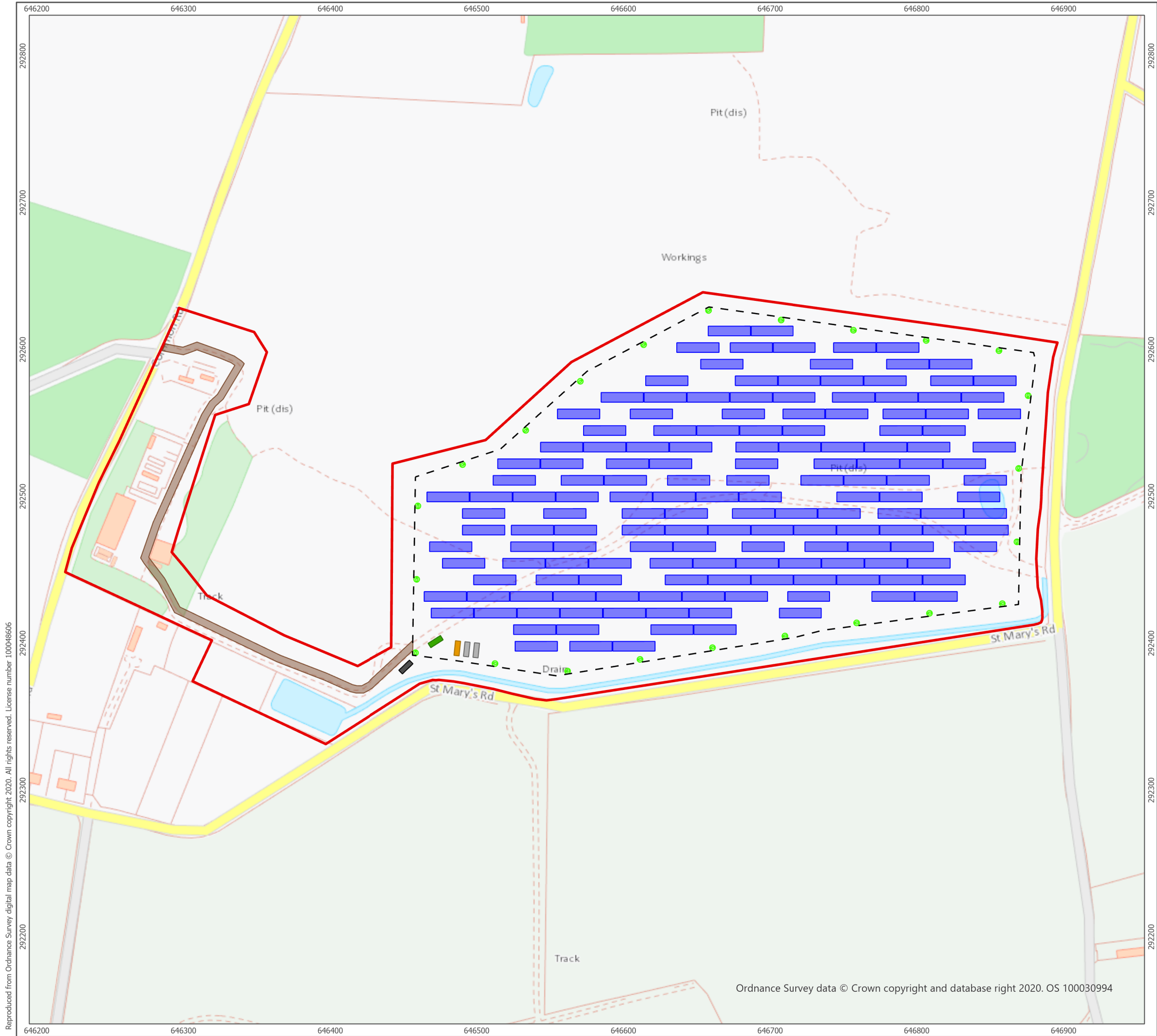
The use of vegetation under the PV array drip line will reduce the potential for surface water run-off rates to increase at the Site.

Table 1 shows that the residual risk of the Development flooding from all sources is Negligible to Low.

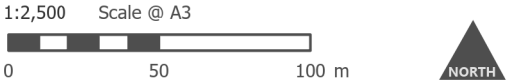
**Table 1: Risk of Development Flooding**

Flooding Source	Potential Risk				Comment	Residual Risk
	Negligible	Low	Mod	High		
Fluvial (River)	✓				The Development site is located in Flood Zone 1, an area described as "low probability" categorised as being the lowest flood risk and comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year.	Negligible
Pluvial (Surface Water)		✓			Pluvial flooding is limited to 900 mm during the 1:100-year events.  Acknowledging the unmanned nature and raised PV lines designed, pluvial flooding is considered of low risk.	Low
Groundwater	✓				Grounds at the nearest borehole comprise clays up to depths of 36 m with no groundwater. Therefore, the groundwater flooding is considered negligible.	Negligible
Reservoirs	✓				Not modelled to flood should the retaining wall of the nearest reservoir fail.	Negligible
Tidal	✓				Analysis of EA Flooding from Rivers and the Sea shows the Site is located outside of Tidal modelling extents.	Negligible

## **APPENDIX A – SITE LAYOUT**



- Planning Application Boundary
- Fencing
- PV Array
- Client Side Switching Station
- DNO Switching Station
- Battery Energy Storage System
- General Storage Container
- Access Road
- CCTV



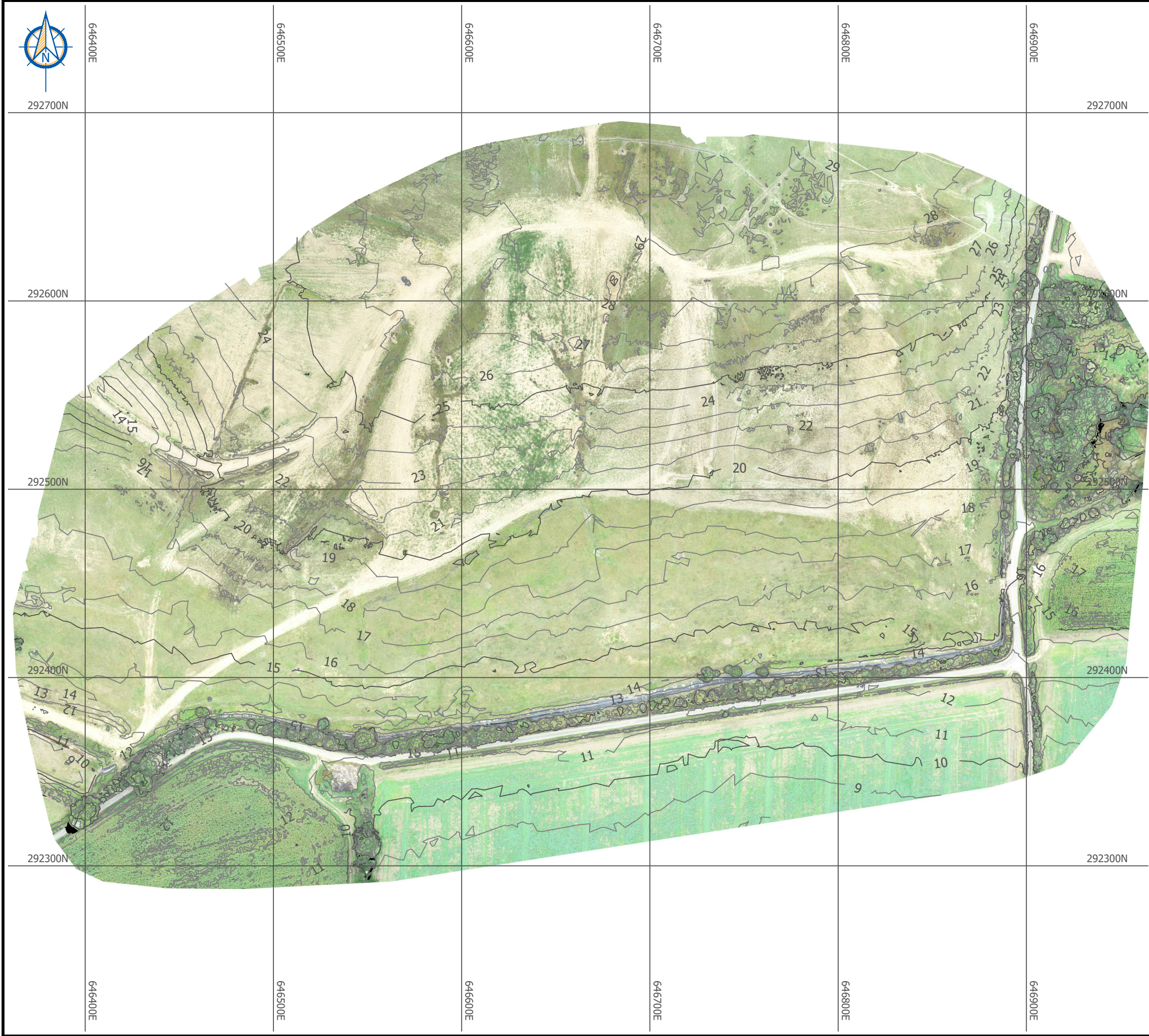
Produced By: EL	Ref: 3757-REP-005
Checked By: AnM	Date: 07/12/2020

**Site Layout Plan**  
Planning Drawing 2

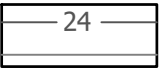
**Aldeby Solar Park**  
Planning Application

## **APPENDIX B – TOPOGRAPHIC SURVEY**





**LEGEND**



Contours 1m intervals (mAOD)

**NOTES**

- Survey undertaken by Drone Tech Solutions 07.09.2020
- 3D Data supplied to GWP Consultants for drawing production and 3D contour information.

Version	Revision and compilation notes	Date
a	Issued to Client	02.10.2020

Client  
Drone Tech Solutions

Project  
Aldeby





**GWP** consultants  
Upton House  
Market Street, Charlbury  
Oxfordshire OX7 3PJ  
United Kingdom  
GWP Consultants LLP. Registered No. OC326183.  
Registered Office: Upton House, Market Street, Charlbury, Oxfordshire OX7 3PJ, UK.

tel +44 (0)1608 810374  
fax +44 (0)1608 810093  
e-mail info@gwp.uk.com  
web www.gwp.uk.com

Date 02.10.2020	Drawn DW	Checked JCB	Scale 1:2000 at A3
Drawing Ref DTSSV2009	Drawing No 1	Version a	