FLOOD RISK ASSESSMENT & SURFACE WATER DRAINAGE STRATEGY

Chimmens Solar Farm

Mussenden Lane, Horton Kirby, Kent

On behalf of RES Ltd
Date: 30.10.2023 | Pegasus Ref: P22-1221 – Author: Maja Raicevic

Document Management

Version	Date	Author	Checked/ Approved by:	Reason for revision
Version 1	23.10.2023	Maja Raicevic	Lucy Ginn/ Luke Johnson	First Issue
Version 2	27.10.2023	Maja Raicevic	Lucy Ginn	Minor updates following client comments
Version 3	30.10.2023	Maja Raicevic	Lucy Ginn	Minor updates following client comments

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1. Introduction

Background

1.1. Pegasus Group Ltd has been appointed by RES Ltd to undertake a Flood Risk Assessment (FRA) and a Surface Water Drainage Strategy for a Solar Farm development at Chimmens Solar Farm, Mussenden Lane, Horton Kirby, Kent.

1.2. This assessment considers the risks of all types of flooding to the site including tidal, fluvial, surface, historic, groundwater, sewer and artificial sources.

National and Local Policies

1.3. The National Planning Policy Framework (NPPF) states that a site-specific Flood Risk Assessment (FRA) will be required for proposals:

a) that are greater than 1 hectare (ha) in area within Flood Zone 1;

b) that are located in Flood Zone 2 or 3 (including minor development and change of use);

c) in an area within Flood Zone 1 which has critical drainage problems;

d) in an area within Flood Zone 1 identified in a Strategic Flood Risk Assessment as being at increased flood risk in the future;

e) in an area in Flood Zone 1 that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

1.4. The site is approximately 99 hectares in size and sits entirely within Flood Zone 1. Therefore, a full FRA is required.

1.5. As of April 2015, the legislation for dealing with FRAs changed, with additional emphasis placed on the use of Sustainable Drainage Systems (SuDS) within drainage schemes for new developments.

1.6. In February 2016, the Environment Agency (EA) introduced new guidance relating to the climate change allowances that must be considered within an FRA. Since 2016, the allowances for sea level rise, peak river flow and peak rainfall have each been updated.

1.7. Given the above, any new planning application that requires an FRA will also require a surface water drainage strategy to be submitted. The drainage strategy must demonstrate the use of SuDS within the design and should be in line with the requirements as set out within the National Planning Policy Framework Technical Guidance (NPPFTG). The drainage strategy must also account for climate change over the lifetime of the development, in accordance with the climate change allowances published by the EA.

1.8. The Sevenoaks District Council Strategic Flood Risk Assessment (date: August 2022; JBA Consulting) has been reviewed to inform the report. The Sevenoaks District Council SFRA key objectives are:

- To take into account the latest flood risk policy.

- Take into account the latest flood risk information and available data.
- To provide specific flood risk analysis for sites identified by the Council as part of their Local Plan preparation.
- To provide a comprehensive mapping to support the Local Plan.

2. Existing Site & Hydrology

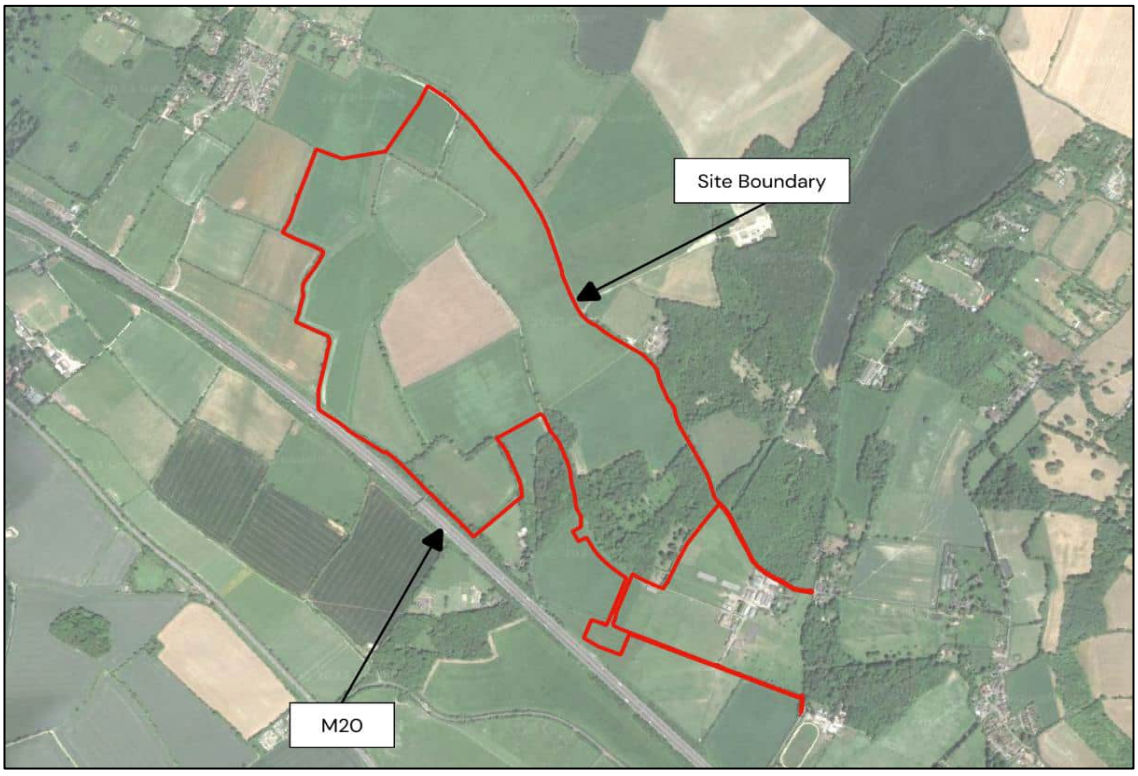
Site Location & Existing Conditions

2.1. The site is approximately 99ha in size and is currently entirely a greenfield area.

2.2. The site is predominantly bounded by undeveloped land on all sides with M20 road bounding the south side of the development.

2.3. Approximate site co-ordinates at the centre of the site are E: 556767; N: 166940, with the nearest postcode being DA3 8NX.

Figure 2.1 – Site Location



2.4. A site specific topographical survey was undertaken by Brunel Surveys Ltd (drawing number: 25672-500-01; date: June 2023). Levels across the fields fall in different directions. The highest point of 126.14mAOD is located in the southeastern end of the site and the lowest point is shown at the western end of the site with an elevation of 59.08mAOD.

2.5. A copy of this topographical survey can be found in **Appendix A**.

Existing Drainage and Hydrology

2.6. There are no Main Rivers or Ordinary Watercourses located within the site boundary.

2.7. The closest Main River to the site is the River Darent located approximately 1km northwest of the site boundary. A field ditch bounds the northeastern side of the development. There are no other watercourses located in the close proximity of the site.

2.8. The site is currently a greenfield area, therefore an existing drainage network system is not expected within the site boundary. An underground drainage network may be located beneath the M20, but this is not expected to encroach the site boundary.

2.9. Geological data held by the British Geological Survey (BGS) indicates that the bedrock geology underlying the site comprises of Lewes Nodular Chalk Formation, Seaford Chalk and Newhaven Chalk Formation. There are no superficial deposits overlying the site.

2.10. SoilScapes data shows the soils on site in the west and central portion to be 'Freely draining lime-rich loamy soils'. The eastern portion is shown to be 'Slightly acid loamy and clayey soils with slightly impeded drainage.'

2.11. The hydrogeology aquifer classification defines the site to be a 'Highly productive aquifer'.

3. Proposed Development

3.1. The proposed development is for "construction and operation of a solar farm with all associated works, equipment, necessary infrastructure and biodiversity net gains".

3.2. Proposed operation and maintenance access to the solar site will be provided via an existing access off Mussenden Lane and access to the substation will be via Gabriel Spring Road East. Further information on site access strategy is provided in the Construction Traffic Management Plan (CTMP Pegasus Ref: P22-1221-TR-R001RevA) provided with this planning application.

3.3. The proposed site layouts are submitted separately as part of the planning application.

4. Development Vulnerability & Flood Zone Classification

National Planning Policy Framework (NPPF)

4.1. Local Planning Authorities, (LPA) have a statutory obligation to consult the Environment Agency, (EA) on all applications in flood risk zones. The EA will consider the effects of flood risk in accordance with the NPPF.

4.2. The NPPF requires that, as part of the planning process:

• A 'site specific' Flood Risk Assessment will be undertaken for any site that has a flood risk potential.

• Flood risk potential is minimised by applying a 'sequential approach' to locating 'vulnerable' land uses.

• Sustainable drainage systems are used for surface water disposal where practical.

• Flood risk is managed through the use of flood resilient and resistant techniques.

• Residual risk is identified and safely managed.

4.3. Table 1 of NPPF, categorises flood zones into:

• Zone 1- Low probability (< 1 in 1000 years)

• Zone 2- Medium probability (1 in 1000 – 1 in 100 years for fluvial events and 1 in 1000 – 1 in 200 year for tidal events)

• Zone 3a- High probability (> 1 in 100 years for fluvial events and > 1 in 200 year for tidal events)

• Zone 3b- The functional floodplain (>1 in 30 years)

4.4. The NPPF sets out a matrix indicating the types of development that are acceptable in different Flood Zones (see Table 4.1). The proposal is for a solar farm development which is defined as 'Essential Infrastructure'. The proposed development is located in Flood Zone 1. Essential Infrastructure is appropriate in all flood zones.

Table 4.1 – NPPF Guidance

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	✗	Exception Test Required	Exception Test Required	✓
Zone 3b	Exception Test Required	✗	✗	✗	✓

Sequential Test

4.5. The Sequential Test is required for developments proposed in Flood Zone 2 or 3 unless the proposals are for minor development or change of use. As the site is entirely within Flood Zone 1, the Sequential Test is not required.

Exception Test

4.6. As the site sits entirely within Flood Zone 1, the Exception Test is not required.

5. Site Specific Flooding Issues and Existing Flood Records

5.1. Local Planning Authorities, (LPA) have a statutory obligation to consult the Environment Agency, (EA) on all applications in flood risk zones. The EA will consider the effects of flood risk in accordance with the NPPF.

National Planning Policy Framework (NPPF)

5.2. In accordance with the National Planning Policy Framework, this Flood Risk Assessment considers all sources of flooding including:

a) Fluvial Flooding – from rivers and streams;

b) Tidal Flooding – from sea;

c) Surface Water Flooding – from overland surface water flow and exceedance;

d) Historic Flooding – known historic flooding issues;

e) Groundwater Flooding – from elevated groundwater levels or springs;

f) Flooding from Sewers – exceedance flows from existing sewer systems; and

g) Artificial Sources – reservoirs, canals etc.

Fluvial Flooding

5.3. The closest Main River to the site is the River Darent located approximately 1km north west of the site boundary. A field ditch is bounding the northeastern side of the development. There are no other watercourses located in the close proximity of the site.

5.4. The Flood Map for Planning (Figure 5.1) shows the site to be located within Flood Zone 1 (Low risk). The closest areas shown to be in Flood Zone 2 (Medium risk) and Flood Zone 3 (High risk) and are associated with the River Darent, are located around 750m northwest of the site boundary.

5.5. As the entire site sits within Flood Zone 1, fluvial flood risk to the site is considered to be **Low**.

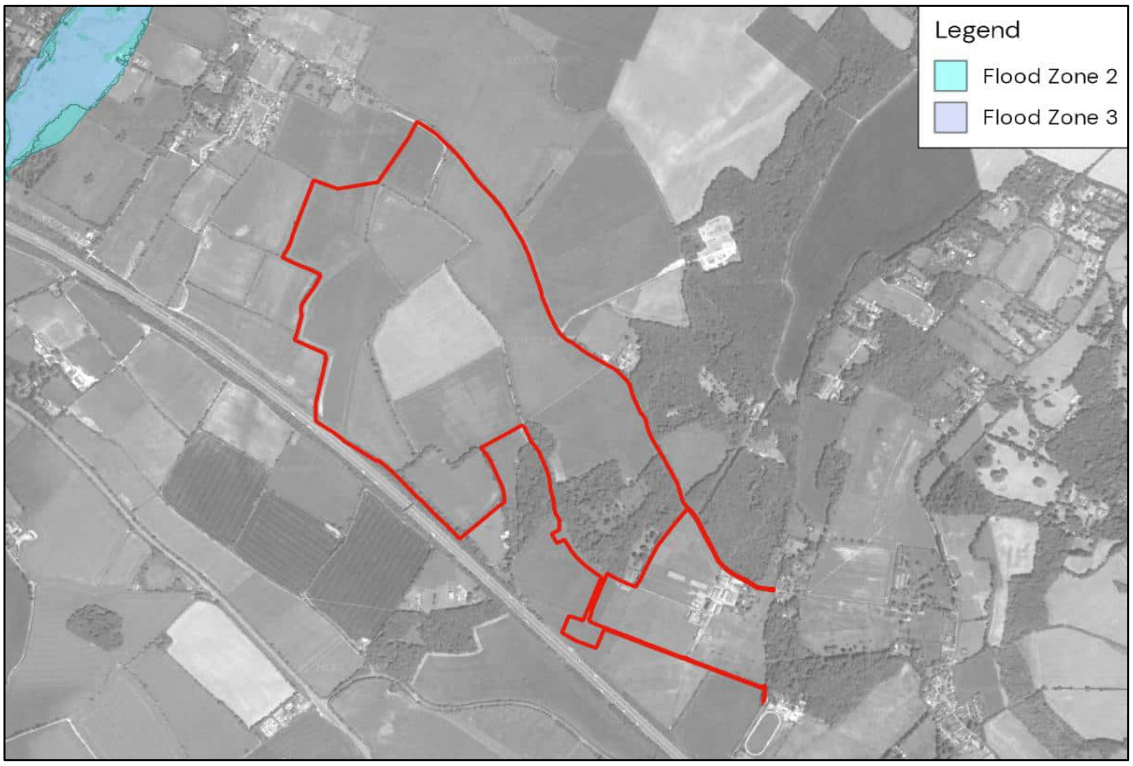
Tidal Flooding

5.6. The Flood Map for Planning (Figure 5.1) shows the site to be located within Flood Zone 1 (Low risk).

5.7. The Sevenoaks SFRA notes 'As Sevenoaks District is located inland, the River Darent is of fluvial influence within the district boundary.'

5.8. Given the above and the elevations on site that are above 60mAOD, the risk of tidal flooding is considered to be **Very Low**.

Figure 5.1 – Flood Map for Planning



Surface Water Flooding

5.9. The Risk of Flooding from Surface Water (RoFSW) dataset shows the majority of the site is not predicted to be impacted by the 1 in 1000 year rainfall event, which represents the worst case scenario within this dataset (see Figure 5.2).

5.10. There is a linear flow path in the central portion of the site which flows in a northerly direction. During a 1 in 1000 year rainfall event, the flooding is generally not predicted to go above 600mm, with only a small area at the far southern end shown to reach 900mm of flood depth.

5.11. The northern portion of the site has surface water flooding predicted which is associated with the locally lower lying topography in that area. During a 1 in 1000 year rainfall event, surface water flood depths are not predicted to go above 300mm here.

5.12. The eastern portion of the site has several locations where the surface water flooding is predicted to reach up to 900mm during a 1 in 1000 year rainfall event.

5.13. No vulnerable infrastructure will be placed in these areas. Solar panel will be raised above the flood level for the worst case scenario.

5.14. As discussed previously, the vast majority of the proposed development is not predicted to be at risk of surface water flooding. Mitigation measures are also proposed to ensure the proposed development remains safe over its lifetime. Therefore, it is considered that the site is at **Low** risk of flooding from surface water.

Figure 5.2 – RoFSW Extents

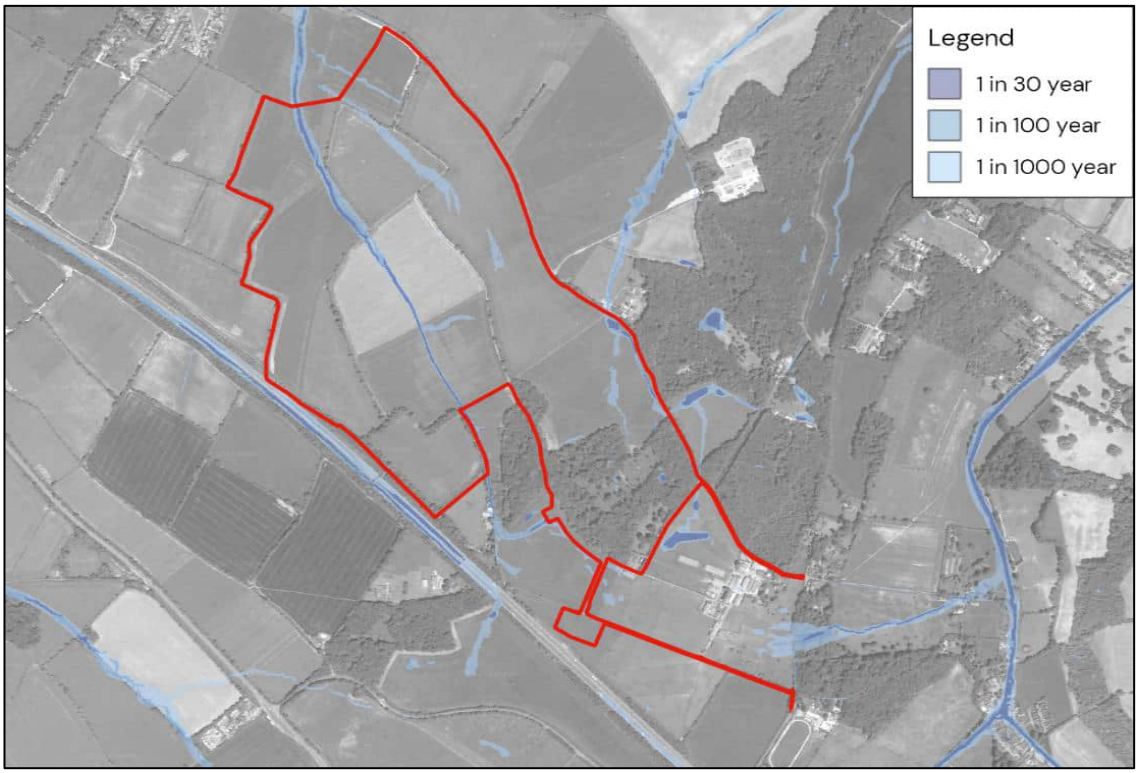
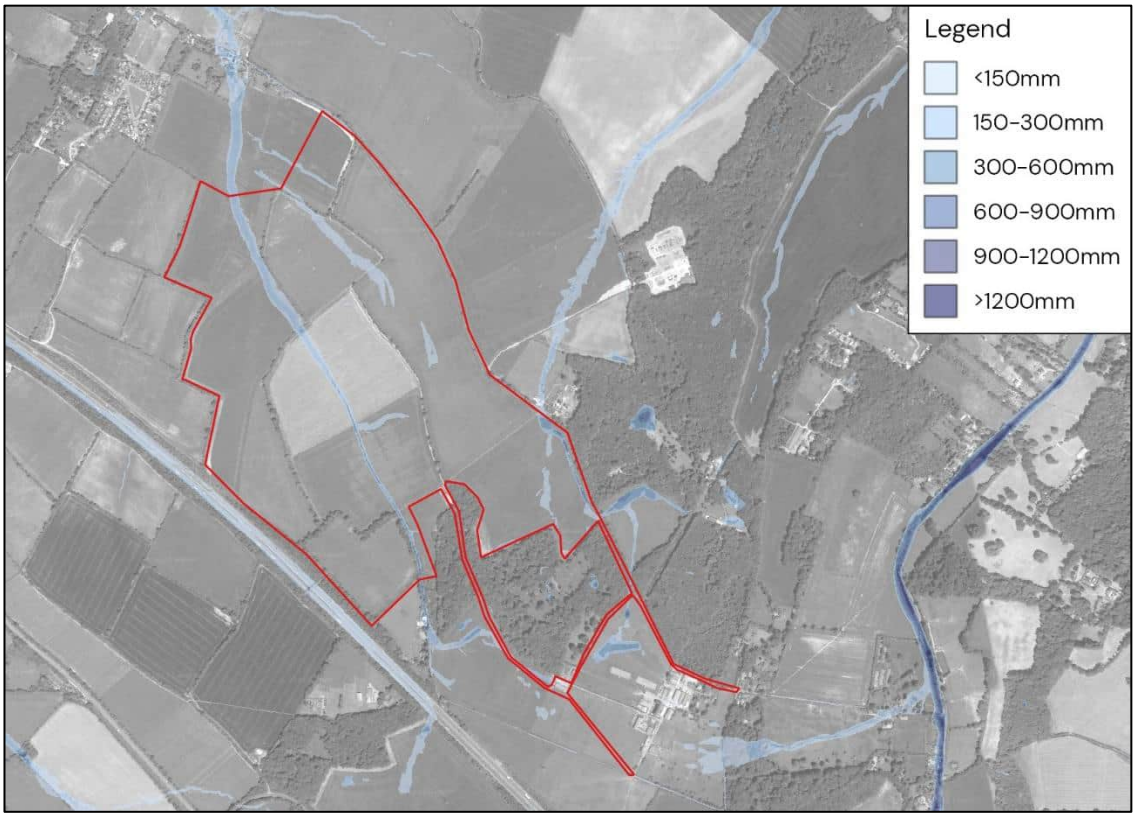


Figure 5.3 – RoFSW 1 in 1,000 year Depths



Historic Flooding

5.15. The Sevenoaks SFRA makes no specific reference of previous historical flooding occurring at the site.

5.16. The EA's Historic Flood Map does not record any historic flood events impacting the site. Therefore, with the with EA Historic Flood Map and the Sevenoaks SFRA making no reference of historical flooding occurring at the site, it can be considered that historic flooding at this site is **Very Low.**

Groundwater Flooding

5.17. Geological data held by the British Geological Survey (BGS) indicates that the site is underlain by permeable chalk. The hydrogeology aquifer classification defines the site to be a 'Highly productive aquifer'. Groundwater emergence may therefore be possible on site.

5.18. SoilScapes data shows the soils on site in the west and central portion to be 'Freely draining lime-rich loamy soils' whilst eastern portion to be 'Slightly acid loamy and clayey soils with slightly impeded drainage.' Soils with impeded drainage will limit the potential for groundwater emergence on site.

5.19. The SFRA notes that the Sevenoaks SWMP (Surface Water Management Plan) and historical flood records provided by Kent County Council indicate that Sevenoaks is vulnerable to or have experienced groundwater flooding in the past.

5.20. The Sevenoaks SWMP (Surface Water Management Plan) also notes that it is difficult to ascertain if the source of flood event in other areas of the district is from groundwater. This is because it may be a result of a combination of sources, or a culverted watercourse being mistaken for a spring or underground stream.

5.21. There are no specific records that indicate that the site was previously flooded by groundwater flooding.

5.22. Topography on site is also not conducive to groundwater flooding – any groundwater to emerge would follow the existing site topography and would drain in different directions, flowing away from the site.

5.23. As determination of groundwater flooding is generally driven by geological factors, which will not be affected by the potential effects of climate change, it is unlikely that climate change will increase the risk of groundwater flooding.

5.24. It is therefore considered that flooding from this source is **Low.**

Flooding from Sewers

5.25. The Sevenoaks SFRA notes that the Sevenoaks district falls within both Southern Water and Thames Water's administrative area. The SFRA indicates that there have been at least 49 sewer flooding incidents since 2011 in the district. No specific postcodes have been provided within the report.

5.26. Given the undeveloped nature of the site and site's surroundings, the site is not considered to be at risk of sewer flooding.

5.27. In an event of sewer flooding, flows would not remain on site due to the site's topography.

5.28. The risk of sewer flooding to the site is therefore considered to be **Low.**

Flooding from Artificial Sources

5.29. The EA's Reservoir Flood Extents data shows that the site is entirely beyond the extent of flooding predicted should a catastrophic reservoir breach occur.

5.30. As determination of reservoir flooding is principally driven by factors which will not be affected by the potential effects of climate change, it is unlikely that climate change will increase the risk of reservoir failure flooding.

5.31. There are no other artificial sources of flooding or canals located in the vicinity of the site that would present a flood risk.

5.32. Therefore, it is considered that the development is in **Low** risk of flooding from reservoirs, canals and artificial sources.

Post Development Residual Flood Risk Summary

5.33. The risk of flooding is summarised in Table 5.1:

Table 5.1 – Flood Risk to the Site from All Sources

Flood Source	Flood Risk	Mitigation/Comments
Tidal	Very Low	• The site is within Flood Zone 1, at Low risk of flooding. Due to the site's inland location and elevated ground levels (>59mAOD) the site is considered to be at Very Low risk.
Fluvial	Low	• The site is within Flood Zone 1, at Low risk of flooding.
Surface Water	Low	• The RoFSW dataset shows that most of the site is not predicted to be impacted by a 1 in 1,000 year rainfall event and is at Very Low risk of surface water flooding. • The areas at Low Risk do not overlap with the locations of any of the vulnerable infrastructure. • Solar panels will be raised above the predicted 1 in 1000 year surface water flood depths.
Historic	Very Low	• The SFRA and EA Historic Flood Map make no reference of historical flooding occurring at site.

Flood Source	Flood Risk	Mitigation/Comments
Groundwater	Low	• The site is underlain by permeable chalk geology and a highlight productive aquifer, yielding the potential for groundwater emergence on site. • Soils with impeded drainage on site will limit the potential for groundwater emergence • Topography on site is not conducive to groundwater flooding.
Sewers	Low	• As the site is entirely a greenfield land, it is unlikely that there is an existing underground drainage network located within the site boundary. • There are no records of sewer flooding occurring at site.
Artificial	Low	• The EA's Reservoir Flood Extents data does not show any risk of reservoir flooding should a catastrophic breach occur. • There are no other artificial sources of flooding or canals located in the vicinity of the site that would present a flood risk.

Access & Egress

5.34. Proposed operation and maintenance access to the solar site will be provided via an existing access off Mussenden Lane and access to the substation will be via Gabriel Spring Road East. These access locations are not predicted to be at significant risk of flooding from any source.

5.35. In addition to the above, the site will be managed remotely and only visited occasionally for maintenance. Site access and egress should therefore not be needed during an extreme flood event.

6. Mitigation Measures and Surface Water Drainage

6.1. This section summarises the proposed mitigation measures required on site to ensure that:

a) The development is not at significant risk of surface water flooding.

b) The potential impacts of the development on surface water runoff are minimised.

6.2. This section also considers if, with proposed mitigation measures in place, any further measures (such as a surface water drainage strategy) are required to ensure that the proposed development is safe and does not increase flood risk elsewhere.

Surface Water Flood Risk

6.3. As discussed in Section 5, the RoFSW dataset predicts areas of the site to be at risk of surface water flooding.

6.4. To ensure that the proposed development is not at significant risk of surface water flooding, the following measures have been included in the proposed site design:

- No vulnerable infrastructure (inverters, substations etc) is located in areas predicted to be at risk of surface water flooding during an extreme, 1 in 1,000 year, rainfall event.
- All proposed solar panels located in areas predicted to be at risk of flooding during a 1 in 1,000 year surface water flood event will have their lowest edge raised above the predicted 1 in 1,000 year surface water flood depths. Even during an extreme event, surface water will therefore be able to flow freely beneath the panels and surface water flow paths will not be impacted. 1 in 1,000 year surface water flood depths of up to 900mm are predicted on site (see Section 5).

6.5. Overall, with the above mitigation measures in place, the proposed development will not be at significant risk of flooding from surface water.

Impact of Surface Water Runoff

Solar Panels

6.6. The proposed solar panels will generally comprise a 'fixed system' with vertical supports driven directly into the ground and no need for concrete foundations. There will be a minimum gap of 2m between rows of solar panels.

6.7. There is potential for small concrete feet being required for the solar panels in discrete areas if archaeology becomes an issue. Given the small area of concrete foundations expected for the solar panels, the impact on surface water runoff is likely to be negligible. The exact areas of concrete foundations proposed will be confirmed during detailed design and the impacted on surface water runoff, re-assessed.

6.8. At this stage, as no areas of concreate foundations have been confirmed, this assessment of the impact on surface water runoff has presumed all solar panels will comprise a fixed system with vertical supports driven directly into the ground.

6.9. As discussed above, all proposed solar panels will be raised above the predicted 1 in 1,000 year surface water flood depths to allow surface water to flow freely below.

6.10. Given the above, the impact of the proposed solar panels on site is considered to be negligible and no further mitigation measures are proposed.

Vulnerable Infrastructure

6.11. In addition to solar panels, a variety of vulnerable infrastructure is proposed on site including inverters, battery storage and a DNO substation. Additional areas of hardstanding associated with the vulnerable infrastructure are also proposed on site. Overall, the areas of proposed vulnerable infrastructure on site will increase the impermeable area on site and therefore have the potential to increase surface water runoff from the proposed development. A surface water drainage strategy is therefore required to manage runoff from the proposed infrastructure. The proposed surface water drainage strategy is included in Section 7.

Access Tracks

6.12. The proposed access tracks will be constructed with a running surface, with a base/capping layer and subgrade below. The typical track section also includes an adjacent drainage swale which will help manage surface water runoff from the proposed access tracks, should this be required. No further mitigation measures are considered necessary.

Proposed Land Use Change

6.13. The proposals will result in the cessation of agricultural activities at the site which will in turn, result in a variety of beneficial effects which will serve to reduce soil compaction and runoff rates from the site, as listed below:

- The site will not be left without vegetation cover during the winter as experienced with arable farming;
- The site will not be intensively trodden or over grazed; and
- The site will not be regularly traversed by heavy machinery.

6.14. It is also recommended that following installation of the panels, the site is chisel-ploughed or similarly cultivated and seeded with native meadow grass and wildflowers. Chisel-ploughing will reduce soil compaction on the site and promote seed growth; it has been proven to significantly increase infiltration rates thereby reducing runoff rates from the site.

6.15. If grazing is undertaken on site following development, the grazing density will be kept low to limit compaction.

6.16. Additionally, longer meadow type grasses and wildflower vegetation provide high levels of natural attenuation which will serve to reduce the risks of erosion and limit surface water flows across the site. With the implementation of chisel-ploughing, changing the site's primary function to solar power generation will have several potential longer-term benefits regarding surface water runoff rates.

7. Proposed Drainage Strategy

7.6. As discussed above, the proposed vulnerable infrastructure on site will increase the impermeable area on site. To ensure surface water runoff from the development and associated flood risk does not increase as a result of the proposals, a surface water drainage strategy is therefore required.

Surface Water Management

7.7. The SuDS hierarchy demands that surface water run off should be managed as high up the following list as practicably possible:

- Into the ground (infiltration), or then;
- To a surface water body, or then;
- To a surface water sewer, highway drain or another drainage system, or then;
- To a combined sewer.

7.8. In order to determine the most suitable method of surface water disposal from the site the options listed above have been considered as follows:

Infiltration

7.9. Geological data held by BGS indicates that the bedrock geology underlying the site comprises of Lewes Nodular Chalk Formation, Seaford Chalk and Newhaven Chalk Formation. This chalk bedrock is expected to be permeable.

7.10. SoilScapes data shows the soils on site in the west and central portion to be 'Freely draining lime-rich loamy soils' whilst eastern portion to be 'Slightly acid loamy and clayey soils with slightly impeded drainage.'

7.11. Overall, from a desktop review, ground conditions on site appear to be suitable for infiltration. It is therefore proposed to manage surface water runoff from the proposed development with infiltration-based SuDS. Infiltration rates for the source control calculations (**shown in Appendix C**) are used from the neighbouring Horton Wood site.

SuDS selection process

7.12. Various methods of SuDS (Sustainable Drainage Systems) should be considered for use as different methods have constraints attached to them and may not be suitable for this development.

7.13. An assessment of the suitability of different SuDS techniques is summarised in Table 7.1 below. Guidance from 'The SuDS manual' C753 has been used to form the basis of this assessment.

Table 7.1 – Assessment of SuDS Suitability

SuDS Technique	Potentially suitable for this development	Justification
Rainwater Harvesting	No	Unsuitable for a solar farm development.
Green Roofs	No	Unsuitable for a solar farm development.
Infiltration Systems (Soakaways, etc.)	Yes	Proposed to manage runoff from the proposed areas of vulnerable infrastructure.
Filter Strip	Yes	Gravel trenches/filter drains are proposed on site.
Swales	Yes	Could be used for water conveyance.
Bioretention Systems	No	Could be considered during detailed design.
Underground storage	No	Should be avoided.
Detention basins & ponds	Yes	No considered necessary due to small area of impermeable hardstanding to be managed.
Wetlands	No	Not considered suitable due to land take.
Permeable Paving	No	Not considered for the proposed development.

Infiltration Rate

7.14. Because infiltration testing on site has not been conducted, the proposed drainage strategy is based on an estimated infiltration rate of 0.0360m/hr which has been used to design the proposed surface water drainage features. This infiltration rate was also estimated by the adjacent site, Horton Wood Solar Farm (22/02599/FUL) which was approved in February 2023 and is considered the best available information to provide an infiltration rate estimate for this site.

7.15. If infiltration testing is complete during detailed design, the proposed drainage strategy should be updated to reflect the calculated infiltration rates on site or indeed, to direct surface water runoff to a surface water body or sewer network should infiltration prove unviable on site.

Impermeable Area

7.16. As mentioned above, the vulnerable infrastructure proposed on site will increase the impermeable area on site. The vulnerable infrastructure can be divided to two categories: a) the inverters and battery storage areas with associated hardstanding and b) the substation compound.

7.17. Each of the individual inverters and battery storage areas with associated hardstanding comprise of the following impermeable areas:

- Hardstanding Area: 225m^2
- Battery Storage Unit: 30.3m^2
- DC Converter Unit: 8.64m^2
- Inverter and BusPlus Units: 18m^2
- Transformer Units: 12.3m^2

Total impermeable per individual inverter & battery storage area: 294m^2 / **0.029ha**

7.18. It should be noted that the above impermeable area associated with the "hardstanding area" is a conservative assumption as this area will comprise type 1 unbound stone which has a semi-permeable nature.

7.19. The individual inverter and battery storage areas are also grouped in certain locations across the site, with the subsequent impermeable areas detailed below:

- Group one - 0.029 ha
- Group two – 0.058 ha
- Group three – 0.088 ha

7.20. The total substation compound area of **0.3705ha** has been used as impermeable for the proposed surface water drainage strategy.

Climate Change Allowances

7.21. The proposed surface water drainage strategy presented here has been designed to manage surface water runoff for all storm events up to and including the 1 in 100 year plus 25% allowance for climate change.

7.22. This is in accordance with Environment Agency guidance which states that for development with a lifetime of between 2061 and 2100, the central allowance for the 2070s epoch should be used. For the "Darent and Cray Management Catchment", the central allowance for the 2070s epoch for a 1 in 100 year rainfall event is 25%.

Surface Water Drainage Strategy

7.23. It is proposed to manage surface water runoff from the proposed impermeable areas on site (as detailed above) with a series of gravel trenches (**see Appendix D**).

7.24. For each of the individual inverters and battery storage areas with associated hardstanding on site which yield 0.029ha of impermeable hardstanding, a 64.4m long infiltration trench is proposed to wrap around the proposed infrastructure, situated within the proposed footprint, to manage surface water runoff from this area. An infiltration trench width of 0.6m and depth of 1.0m is required to manage surface water runoff from the storage areas for all storm events up to and including the 1 in 100 year plus 25% climate change event.

7.25. The individual inverters and battery storage areas that have an impermeable area of 0.058ha (see above) are proposed to have a 97.2m long infiltration trench wrapped around the proposed infrastructure, situated within the proposed footprint, to manage surface water runoff from this area. An infiltration trench width of 0.9m and depth of 1.0m is required to manage surface water runoff from the storage areas for all storm events up to and including the 1 in 100 year plus 25% climate change event.

7.26. The individual inverters and battery storage areas that have an impermeable area of 0.088ha (see above) have a 152.7m long infiltration trench proposed to wrap around the proposed infrastructure, situated within the proposed footprint, to manage surface water runoff from this area. An infiltration trench width of 0.9m and depth of 1.0m is required to manage surface water runoff from the storage areas for all storm events up to and including the 1 in 100 year plus 25% climate change event.

7.27. It is also proposed to locate an infiltration trench just outside the substation footprint to manage surface water runoff from this area. Here, a gravel trench 122m long, 3m wide and 1.7m deep is required to manage surface water runoff from the storage areas for all storm events up to and including the 1 in 100 year plus 25% climate change event.

7.28. The proposed infiltration trenches on site will allow surface water runoff to be stored prior to infiltration into the surrounding ground.

Water Quality

7.29. The SuDS Manual (CIRIA C753) states that the design of surface water drainage should consider minimising contaminants in surface water runoff discharged from the site. The level of treatment required depends on the proposed land use, according to the pollution hazard indices.

7.30. Table 7.2 shows the pollution indices for the proposed development. The category of "other roofs" is considered to best describe the areas to be managed.

Table 7.2 – Pollution Hazard Indices

Pollutant	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2	0.05

7.31. Table 7.3 shows the pollution mitigation indices. It is shown that the pollution mitigation indices exceed the proposed development pollution indices. Therefore, the mitigation measures are deemed adequate for the site.

Table 7.3 – Pollution Mitigation Indices

Type of SuDS component	Total suspended solids (TSS)	Metals	Hydro-carbons
Filter Drain	0.4	0.4	0.4

8. Summary

8.1. The site is approximately 99Ha in area is currently entirely greenfield. The site is proposed for a solar farm development with associated infrastructure.

8.2. The proposed development is located in Flood Zone 1. Areas of surface water flood risk are also predicted on site. Mitigation measures are proposed to help protect the proposed development from surface water flooding over its lifetime. Mitigation measures include raising the lowest edge of proposed solar panels above proposed flood depths and ensuring vulnerable infrastructure is sequentially located in areas of lowest flood risk.

8.3. The site is not considered to be at significant risk of flooding from any source and access and egress is not predicted to be impeded during an extreme flood event.

8.4. Surface water runoff from proposed infrastructure will be managed with a series of gravel trenches designed to manage surface water runoff from all storm events up until and including the 1 in 100 year plus 25% allowance for climate change.

8.5. With mitigation measures and the proposed surface water drainage strategy in place, the proposed development will not increase flood risk on site or elsewhere.

8.6. The proposal is considered to accord with the requirements of the National Planning Policy Framework (NPPF) with residual risk to the site fully mitigated, and as such considered low risk.

Appendix A – Topographical Survey

SHEET LAYOUT

1 2 3 4 5 6 7 8 9

NORTH

W E S

SCALE

0m 12.5m 25m 50m

SURVEY STATIONS

Name	Easting	Northing	Height	Remark
PEG1	556632.306	166739.060	83.009	Peg
PEG2	556505.967	166695.907	87.796	Peg
PEG3	556489.659	166982.985	73.500	Peg
PEG4	556835.895	167210.706	78.383	Peg
PEG5	557165.583	166459.060	118.672	Peg
PEG6	557370.783	166277.733	124.785	Peg
PEG7	557166.897	166420.121	118.352	Peg
PGM1	556887.316	167018.150	86.795	PGM
PGM2	556770.542	166918.996	74.531	PGM
PGM3	556802.708	166346.263	115.210	PGM
PGM4	556677.003	166324.310	115.351	PGM
PGM5	556636.525	167106.402	64.329	PGM
PGM6	556669.809	167308.663	64.280	PGM
PGM7	556837.089	167502.156	69.687	PGM
PGM8	556845.427	167223.082	76.757	PGM
PGM9	556991.045	167095.294	88.651	PGM
PGM10	557021.414	166853.628	100.417	PGM
PGM11	557081.753	166771.321	107.628	PGM
PGM12	557118.468	166593.329	112.344	PGM
PGM13	557433.015	166658.776	116.004	PGM
PGM14	557508.750	166228.845	126.231	PGM
PGM15	557527.955	165866.394	133.359	PGM
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PGM17	557022.370	166341.120	102.219	PGM
PGM18	556825.380	166329.193	116.369	PGM
T1	557201.656	166370.842	120.839	Nail
T2	557240.325	166284.093	121.961	Nail
T4	557266.740	166124.706	126.743	Nail
T5	557335.447	165946.352	130.415	Nail
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C1	556858.344	166394.606	109.695	Peg

LEGEND

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BL	Bollard	GY	Gulley	THL	Threshold Level
BH	Bore Hole	Ht	Height	TL	Traffic Light
BS	Bus Stop	IC	Inspection Cover	TP	Telegraph Pole
BT	Telecom Cover	IL	Invert Level	TS	Traffic Sign
CL	Cover Level	KI	Kerb Inlet	ITS	Illuminated TS
DP	Down Pipe	LC	Lamp Column	TT	Tree Top
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GPR	Ground Penetrating Radar	SV	Stop Valve	WO	Wash Out

KEY

STN1 SURVEY STATION — GATE — BANK — FOLIAGE — CLIFF

50m — MAJOR CONTOUR

MINOR CONTOUR (0.25m interval)

NOTES

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Grid Orientation: OS National Grid OSTN15

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CLIENT
Pegasus Group

JOB TITLE
Topographical Survey

Chimmens Solar Farm
Kent
DA3 8NJ

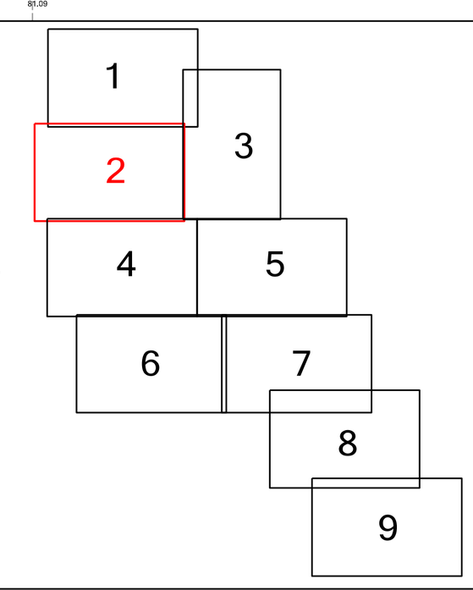
Sheet 1 of 9

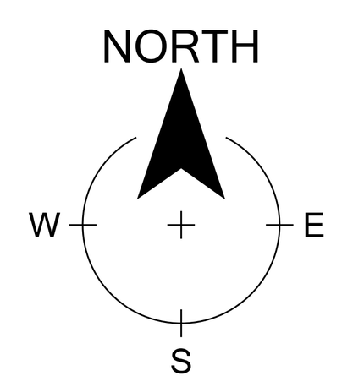
REVISIONS

SCALE	A0 Sheet @ 1 to 500		
DATE	June 2023	SURVEYED BY	NB JH GW
DRAWN BY	JH PJW NB	CHECKED BY	PJW

DRAWING No.
25672-500-01

SHEET LAYOUT





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KEY

STN1 SURVEY STATION

GATE

BANK

FOLIAGE

CLIFF

50m MAJOR CONTOUR

MINOR CONTOUR (0.25m interval)

NOTES

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CLIENT

Pegasus Group

JOB TITLE

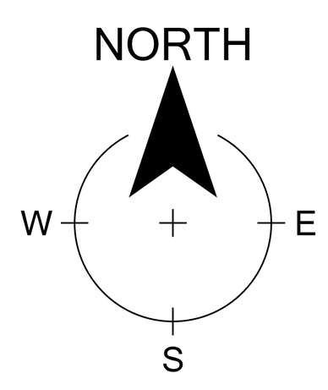
Topographical Survey

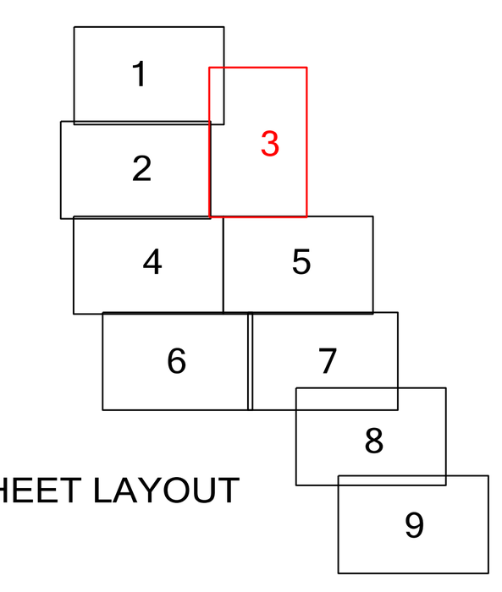
Chimmens Solar Farm
Kent
DA3 8NJ

Sheet 2 of 9

REVISIONS

SCALE	A0 Sheet @ 1 to 500
DATE June 2023	SURVEYED BY NB JH GW
DRAWN BY JH PJW NB	CHECKED BY PJW
DRAWING No.	25672-500-01





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LEGEND

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GPR	Ground Penetrating Radar	SV	Stop Valve	WO	Wash Out

KEY

STN1 SURVEY STATION — GATE — BANK — FOLIAGE — CLIFF

50m — MAJOR CONTOUR

MINOR CONTOUR (0.25m interval)

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CLIENT

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Chimmens Solar Farm
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DA3 8NJ

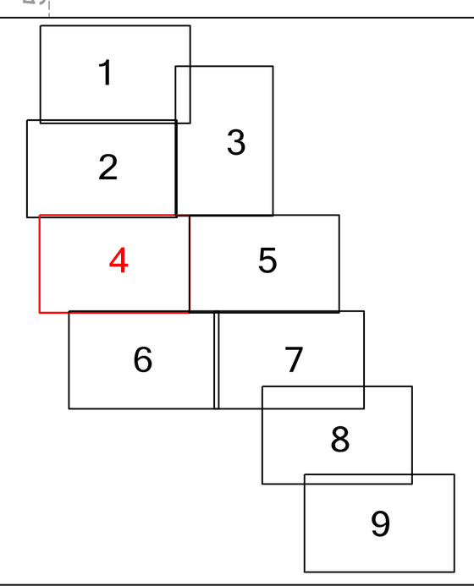
Sheet 3 of 9

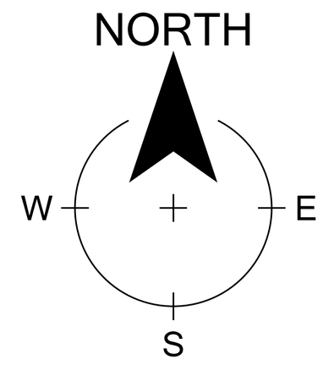
REVISIONS

SCALE	A0 Sheet @ 1 to 500
DATE: June 2023	SURVEYED BY: NB JH GW
DRAWN BY: JH PJW NB	CHECKED BY: PJW

DRAWING No.
25672-500-01

SHEET LAYOUT





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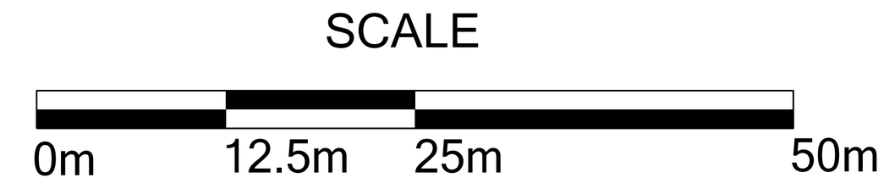

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Sheet 4 of 9

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SURVEYED BY	NB JH GW
DRAWN BY	JH PJW NB
CHECKED BY	PJW
DRAWING No.	25672-500-01

SHEET LAYOUT

1		
2	3	
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	8	
	9	

NORTH

W E S

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0m 12.5m 25m 50m

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PGM2	556770.542	166918.996	74.531	PGM
PGM3	556802.708	166346.263	115.210	PGM
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PGM5	556636.525	167106.402	64.329	PGM
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PGM11	557081.753	166771.321	107.628	PGM
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N6	557737.869	165671.804	135.777	Nail
N7	557702.476	165606.405	136.516	Nail
N9	557880.176	165536.880	133.472	Nail
N2	557696.684	165750.107	135.622	Nail
N8	557527.009	165676.814	136.449	Nail
N10	557971.407	165499.501	131.144	Nail
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LEGEND

AV	Air Valve	GV	Gas Valve	SVP	Soil Vent Pipe
BL	Bollard	GY	Gulley	THL	Threshold Level
BH	Bore Hole	Ht	Height	TL	Traffic Light
BS	Bus Stop	IC	Inspection Cover	TP	Telegraph Pole
BT	Telecom Cover	IL	Invert Level	TS	Traffic Sign
CL	Cover Level	KI	Kerb Inlet	ITS	Illuminated TS
DP	Down Pipe	LC	Lamp Column	TT	Tree Top
EY	Electricity Cover	MH	Manhole	TV	Cable TV Cover
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FP	Fence Post	SL	Silt Level	WL	Water Level
GP	Gate Post	SP	Sign Post	WM	Water Meter
GPR	Ground Penetrating Radar	SV	Stop Valve	WO	Wash Out

KEY

STN1 SURVEY STATION

GATE

BANK

FOLIAGE

CLIFF

50m MAJOR CONTOUR

MINOR CONTOUR (0.25m interval)

NOTES

Level Datum: OS National Grid OSGM15

Grid Orientation: OS National Grid OSTN15

Scale Factor: Local Scale Factor=0.99990712

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CLIENT

Pegasus Group

JOB TITLE

Topographical Survey

Chimmens Solar Farm
Kent
DA3 8NJ

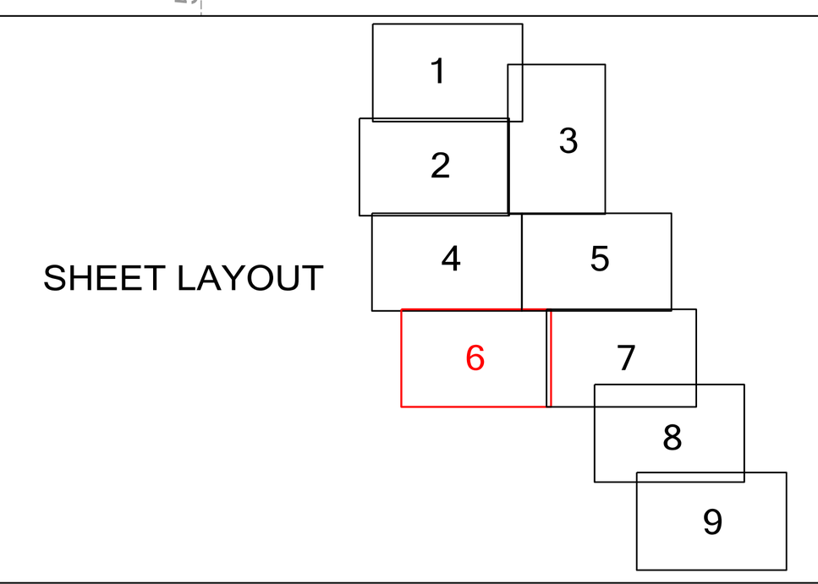
Sheet 5 of 9

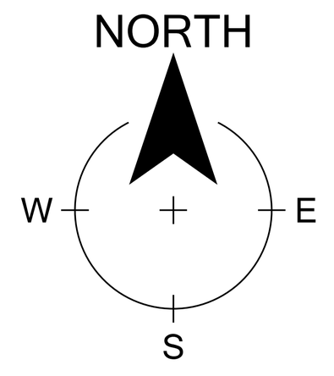
REVISIONS

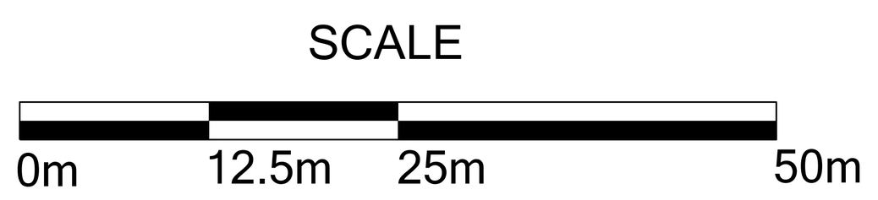
SCALE	A0 Sheet @ 1 to 500
DATE: June 2023	SURVEYED BY: NB JH GW
DRAWN BY: JH PJW NB	CHECKED BY: PJW

DRAWING No.

25672-500-01







SURVEY STATIONS

Name	Easting	Northing	Height	Remark
PEG1	556632.306	166739.060	83.009	Peg
PEG2	556505.967	166695.907	87.796	Peg
PEG3	556489.659	166982.985	73.500	Peg
PEG4	556835.895	167210.706	78.383	Peg
PEG5	557165.583	166459.060	118.672	Peg
PEG6	557370.783	166277.733	124.785	Peg
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LEGEND

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GPR	Ground Penetrating Radar	SV	Stop Valve	WO	Wash Out

KEY

STN1 SURVEY STATION

GATE

BANK

FOLIAGE

CLIFF

50m MAJOR CONTOUR

MINOR CONTOUR (0.25m interval)

NOTES

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Grid Orientation: OS National Grid OSTN15

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CLIENT

Pegasus Group

JOB TITLE

Topographical Survey

Chimmens Solar Farm
Kent
DA3 8NJ

Sheet 6 of 9

REVISIONS

SCALE: A0 Sheet @ 1 to 500

DATE: June 2023

SURVEYED BY: NB JH GW

DRAWN BY: JH PJW NB

CHECKED BY: PJW

DRAWING No. 25672-500-01

SHEET LAYOUT

1 2 3 4 5 6 7 8 9

NORTH

W E S

SCALE

0m 12.5m 25m 50m

SURVEY STATIONS				
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C1	556858.344	166394.606	109.695	Peg

LEGEND

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GPR	Ground Penetrating Radar	SV	Stop Valve	WO	Wash Out

KEY

STN1 SURVEY STATION · GATE · BANK · FOLIAGE · CLIFF

50m MAJOR CONTOUR

MINOR CONTOUR (0.25m interval)

NOTES

Level Datum: OS National Grid OSGM15

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Pegasus Group

JOB TITLE

Topographical Survey

Chimmens Solar Farm
Kent
DA3 8NJ

Sheet 7 of 9

REVISIONS

SCALE	A0 Sheet @ 1 to 500
DATE June 2023	SURVEYED BY NB JH GW
DRAWN BY JH PJW NB	CHECKED BY PJW

DRAWING No.

25672-500-01

SHEET LAYOUT

1 2 3 4 5 6 7 8 9

NORTH

W E S

SCALE

0m 12.5m 25m 50m

SURVEY STATIONS

Name	Easting	Northing	Height	Remark
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LEGEND

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KEY

STN1 SURVEY STATION

GATE

BANK

FOLIAGE

CLIFF

50m MAJOR CONTOUR

MINOR CONTOUR (0.25m interval)

NOTES

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Sheet 8 of 9

REVISIONS

SCALE A0 Sheet @ 1 to 500

DATE June 2023

SURVEYED BY NB JH GW

DRAWN BY JH PJW NB

CHECKED BY PJW

DRAWING No. 25672-500-01

SHEET LAYOUT

1 2 3 4 5 6 7 8 9

NORTH

W E S

SCALE

0m 12.5m 25m 50m

SURVEY STATIONS

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N6	557737.869	165671.804	135.777	Nail
N7	557702.476	165606.405	136.516	Nail
N9	557880.176	165536.880	133.472	Nail
N2	557696.684	165750.107	135.622	Nail
N8	557527.009	165676.814	136.449	Nail
N10	557971.407	165499.501	131.144	Nail
C1	556858.344	166394.606	109.695	Peg

LEGEND

AV	Air Valve	GV	Gas Valve	SVP	Soil Vent Pipe
BL	Bollard	GY	Gulley	THL	Threshold Level
BH	Bore Hole	Ht	Height	TL	Traffic Light
BS	Bus Stop	IC	Inspection Cover	TP	Telegraph Pole
BT	Telecom Cover	IL	Invert Level	TS	Traffic Sign
CL	Cover Level	KI	Kerb Inlet	ITS	Illuminated TS
DP	Down Pipe	LC	Lamp Column	TT	Tree Top
EY	Electricity Cover	MH	Manhole	TV	Cable TV Cover
EOS	End of Survey	MK-(Type)	Marker Post	TWL	Top of Wall level
EOT	End of Trace	OH	Overhead Cable	UTL	Unable to Lift
EP	Electricity Pole	PB	Post Box	UTS	Unable to Survey
ER	Earth Rod	RE	Rodding Eye	UTT	Unable to Trace
FFL	Finished Floor Level	RNP	Road Name Plate	VP	Vent Pipe
FH	Fire Hydrant	SC	Stop Cock (Water)	VT	Vegetation Top
FP	Fence Post	SL	Silt Level	WL	Water Level
GP	Gate Post	SP	Sign Post	WM	Water Meter
GPR	Ground Penetrating Radar	SV	Stop Valve	WO	Wash Out

KEY

STN1 SURVEY STATION — GATE — BANK — FOLIAGE — CLIFF

50m — MAJOR CONTOUR

MINOR CONTOUR (0.25m interval)

NOTES

Level Datum: OS National Grid OSGM15

Grid Orientation: OS National Grid OSTN15

Scale Factor: Local Scale Factor=0.99990712

The contractor is to check and verify all critical dimensions and levels before work starts.

Every effort is made to identify all visible above ground features. However, it may be possible that certain features are obscured at the time of survey.

Brunel Surveys Ltd
Land, Building and Utility Surveyors

Unit 59, Shrivenham Hundred Business Park
Watchfield, Swindon, Wiltshire, SN6 8TY
EMAIL : admin@brunelsurveys.com
WEB : www.brunelsurveys.com
TEL : 01793 784700

CLIENT

Pegasus Group

JOB TITLE

Topographical Survey

Chimmens Solar Farm
Kent
DA3 8NJ

Sheet 9 of 9

REVISIONS

SCALE	A0 Sheet @ 1 to 500
DATE	June 2023
SURVEYED BY	NB JH GW
DRAWN BY	JH PJW NB
CHECKED BY	PJW

DRAWING No.

25672-500-01

Appendix B – Source Control Calculations

Summary of Results for 100 year Return Period (+25%)

Half Drain Time : 74 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	99.614	0.614	1.2	7.1	O K
30 min Summer	99.761	0.761	1.4	8.8	Flood Risk
60 min Summer	99.852	0.852	1.5	9.9	Flood Risk
120 min Summer	99.843	0.843	1.5	9.8	Flood Risk
180 min Summer	99.809	0.809	1.4	9.4	Flood Risk
240 min Summer	99.769	0.769	1.4	8.9	Flood Risk
360 min Summer	99.694	0.694	1.3	8.0	O K
480 min Summer	99.631	0.631	1.2	7.3	O K
600 min Summer	99.578	0.578	1.1	6.7	O K
720 min Summer	99.531	0.531	1.1	6.2	O K
960 min Summer	99.454	0.454	1.0	5.3	O K
1440 min Summer	99.341	0.341	0.8	4.0	O K
2160 min Summer	99.230	0.230	0.7	2.7	O K
2880 min Summer	99.157	0.157	0.6	1.8	O K
4320 min Summer	99.072	0.072	0.5	0.8	O K
5760 min Summer	99.045	0.045	0.4	0.5	O K
7200 min Summer	99.038	0.038	0.3	0.4	O K
8640 min Summer	99.033	0.033	0.3	0.4	O K
10080 min Summer	99.029	0.029	0.3	0.3	O K
15 min Winter	99.692	0.692	1.3	8.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	145.215	0.0	17
30 min Summer	96.128	0.0	31
60 min Summer	60.976	0.0	54
120 min Summer	35.766	0.0	86
180 min Summer	26.043	0.0	120
240 min Summer	20.765	0.0	154
360 min Summer	15.082	0.0	222
480 min Summer	12.031	0.0	288
600 min Summer	10.101	0.0	354
720 min Summer	8.758	0.0	418
960 min Summer	6.997	0.0	542
1440 min Summer	5.108	0.0	792
2160 min Summer	3.727	0.0	1148
2880 min Summer	2.977	0.0	1504
4320 min Summer	2.165	0.0	2208
5760 min Summer	1.726	0.0	2936
7200 min Summer	1.454	0.0	3648
8640 min Summer	1.261	0.0	4312
10080 min Summer	1.115	0.0	5136
15 min Winter	145.215	0.0	17

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.862	0.862	1.5	10.0	Flood Risk
60 min Winter	99.971	0.971	1.6	11.3	Flood Risk
120 min Winter	99.951	0.951	1.6	11.0	Flood Risk
180 min Winter	99.900	0.900	1.6	10.4	Flood Risk
240 min Winter	99.842	0.842	1.5	9.8	Flood Risk
360 min Winter	99.734	0.734	1.3	8.5	Flood Risk
480 min Winter	99.646	0.646	1.2	7.5	O K
600 min Winter	99.572	0.572	1.1	6.6	O K
720 min Winter	99.510	0.510	1.0	5.9	O K
960 min Winter	99.411	0.411	0.9	4.8	O K
1440 min Winter	99.275	0.275	0.7	3.2	O K
2160 min Winter	99.152	0.152	0.6	1.8	O K
2880 min Winter	99.078	0.078	0.5	0.9	O K
4320 min Winter	99.041	0.041	0.4	0.5	O K
5760 min Winter	99.033	0.033	0.3	0.4	O K
7200 min Winter	99.028	0.028	0.3	0.3	O K
8640 min Winter	99.024	0.024	0.2	0.3	O K
10080 min Winter	99.021	0.021	0.2	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	96.128	0.0	31
60 min Winter	60.976	0.0	58
120 min Winter	35.766	0.0	90
180 min Winter	26.043	0.0	128
240 min Winter	20.765	0.0	166
360 min Winter	15.082	0.0	236
480 min Winter	12.031	0.0	306
600 min Winter	10.101	0.0	374
720 min Winter	8.758	0.0	438
960 min Winter	6.997	0.0	568
1440 min Winter	5.108	0.0	820
2160 min Winter	3.727	0.0	1188
2880 min Winter	2.977	0.0	1528
4320 min Winter	2.165	0.0	2192
5760 min Winter	1.726	0.0	2864
7200 min Winter	1.454	0.0	3632
8640 min Winter	1.261	0.0	4344
10080 min Winter	1.115	0.0	5008

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 556538 166708 TQ 56538 66708
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.029

Time (mins) From:	To:	Area (ha)
0	4	0.029

Model Details

Storage is Online Cover Level (m) 100.000

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.03600	Trench Width (m)	0.6
Infiltration Coefficient Side (m/hr)	0.03600	Trench Length (m)	64.4
Safety Factor	1.0	Slope (1:X)	0.0
Porosity	0.30	Cap Volume Depth (m)	1.000
Invert Level (m)	99.000	Cap Infiltration Depth (m)	1.000

Summary of Results for 100 year Return Period (+25%)

Half Drain Time : 98 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	99.550	0.550	2.0	14.4	O K
30 min Summer	99.689	0.689	2.2	18.1	O K
60 min Summer	99.787	0.787	2.4	20.6	Flood Risk
120 min Summer	99.781	0.781	2.4	20.5	Flood Risk
180 min Summer	99.755	0.755	2.4	19.8	Flood Risk
240 min Summer	99.723	0.723	2.3	19.0	Flood Risk
360 min Summer	99.660	0.660	2.2	17.3	O K
480 min Summer	99.606	0.606	2.1	15.9	O K
600 min Summer	99.559	0.559	2.0	14.7	O K
720 min Summer	99.516	0.516	1.9	13.5	O K
960 min Summer	99.443	0.443	1.7	11.6	O K
1440 min Summer	99.331	0.331	1.5	8.7	O K
2160 min Summer	99.217	0.217	1.3	5.7	O K
2880 min Summer	99.140	0.140	1.1	3.7	O K
4320 min Summer	99.057	0.057	1.0	1.5	O K
5760 min Summer	99.042	0.042	0.8	1.1	O K
7200 min Summer	99.036	0.036	0.7	0.9	O K
8640 min Summer	99.031	0.031	0.6	0.8	O K
10080 min Summer	99.027	0.027	0.5	0.7	O K
15 min Winter	99.619	0.619	2.1	16.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	145.215	0.0	18
30 min Summer	96.128	0.0	32
60 min Summer	60.976	0.0	60
120 min Summer	35.766	0.0	90
180 min Summer	26.043	0.0	124
240 min Summer	20.765	0.0	160
360 min Summer	15.082	0.0	228
480 min Summer	12.031	0.0	296
600 min Summer	10.101	0.0	362
720 min Summer	8.758	0.0	426
960 min Summer	6.997	0.0	556
1440 min Summer	5.108	0.0	806
2160 min Summer	3.727	0.0	1168
2880 min Summer	2.977	0.0	1528
4320 min Summer	2.165	0.0	2204
5760 min Summer	1.726	0.0	2936
7200 min Summer	1.454	0.0	3648
8640 min Summer	1.261	0.0	4312
10080 min Summer	1.115	0.0	5112
15 min Winter	145.215	0.0	18

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.781	0.781	2.4	20.5	Flood Risk
60 min Winter	99.899	0.899	2.6	23.6	Flood Risk
120 min Winter	99.890	0.890	2.6	23.3	Flood Risk
180 min Winter	99.854	0.854	2.5	22.4	Flood Risk
240 min Winter	99.808	0.808	2.5	21.2	Flood Risk
360 min Winter	99.718	0.718	2.3	18.8	Flood Risk
480 min Winter	99.640	0.640	2.1	16.8	O K
600 min Winter	99.572	0.572	2.0	15.0	O K
720 min Winter	99.513	0.513	1.9	13.5	O K
960 min Winter	99.414	0.414	1.7	10.9	O K
1440 min Winter	99.271	0.271	1.4	7.1	O K
2160 min Winter	99.136	0.136	1.1	3.6	O K
2880 min Winter	99.058	0.058	1.0	1.5	O K
4320 min Winter	99.038	0.038	0.7	1.0	O K
5760 min Winter	99.031	0.031	0.6	0.8	O K
7200 min Winter	99.026	0.026	0.5	0.7	O K
8640 min Winter	99.022	0.022	0.4	0.6	O K
10080 min Winter	99.020	0.020	0.4	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	96.128	0.0	31
60 min Winter	60.976	0.0	58
120 min Winter	35.766	0.0	94
180 min Winter	26.043	0.0	134
240 min Winter	20.765	0.0	172
360 min Winter	15.082	0.0	244
480 min Winter	12.031	0.0	316
600 min Winter	10.101	0.0	384
720 min Winter	8.758	0.0	450
960 min Winter	6.997	0.0	580
1440 min Winter	5.108	0.0	836
2160 min Winter	3.727	0.0	1192
2880 min Winter	2.977	0.0	1504
4320 min Winter	2.165	0.0	2196
5760 min Winter	1.726	0.0	2928
7200 min Winter	1.454	0.0	3616
8640 min Winter	1.261	0.0	4288
10080 min Winter	1.115	0.0	4984

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 556538 166708 TQ 56538 66708
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.058

Time (mins) From:	To:	Area (ha)
0	4	0.058

Model Details

Storage is Online Cover Level (m) 100.000

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.03600	Trench Width (m)	0.9
Infiltration Coefficient Side (m/hr)	0.03600	Trench Length (m)	97.2
Safety Factor	1.0	Slope (1:X)	0.0
Porosity	0.30	Cap Volume Depth (m)	1.000
Invert Level (m)	99.000	Cap Infiltration Depth (m)	1.000

Summary of Results for 100 year Return Period (+25%)

Half Drain Time : 97 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	99.530	0.530	3.0	21.9	O K
30 min Summer	99.664	0.664	3.4	27.4	O K
60 min Summer	99.757	0.757	3.7	31.2	Flood Risk
120 min Summer	99.751	0.751	3.7	30.9	Flood Risk
180 min Summer	99.724	0.724	3.6	29.9	Flood Risk
240 min Summer	99.693	0.693	3.5	28.6	O K
360 min Summer	99.632	0.632	3.3	26.1	O K
480 min Summer	99.579	0.579	3.2	23.9	O K
600 min Summer	99.533	0.533	3.0	22.0	O K
720 min Summer	99.491	0.491	2.9	20.3	O K
960 min Summer	99.420	0.420	2.7	17.3	O K
1440 min Summer	99.311	0.311	2.3	12.8	O K
2160 min Summer	99.200	0.200	2.0	8.2	O K
2880 min Summer	99.126	0.126	1.8	5.2	O K
4320 min Summer	99.052	0.052	1.5	2.1	O K
5760 min Summer	99.041	0.041	1.2	1.7	O K
7200 min Summer	99.034	0.034	1.0	1.4	O K
8640 min Summer	99.030	0.030	0.9	1.2	O K
10080 min Summer	99.026	0.026	0.8	1.1	O K
15 min Winter	99.597	0.597	3.2	24.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	145.215	0.0	18
30 min Summer	96.128	0.0	32
60 min Summer	60.976	0.0	60
120 min Summer	35.766	0.0	90
180 min Summer	26.043	0.0	124
240 min Summer	20.765	0.0	158
360 min Summer	15.082	0.0	228
480 min Summer	12.031	0.0	296
600 min Summer	10.101	0.0	362
720 min Summer	8.758	0.0	426
960 min Summer	6.997	0.0	556
1440 min Summer	5.108	0.0	806
2160 min Summer	3.727	0.0	1168
2880 min Summer	2.977	0.0	1524
4320 min Summer	2.165	0.0	2204
5760 min Summer	1.726	0.0	2920
7200 min Summer	1.454	0.0	3608
8640 min Summer	1.261	0.0	4320
10080 min Summer	1.115	0.0	5128
15 min Winter	145.215	0.0	18

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.753	0.753	3.7	31.0	Flood Risk
60 min Winter	99.865	0.865	4.0	35.7	Flood Risk
120 min Winter	99.855	0.855	4.0	35.3	Flood Risk
180 min Winter	99.820	0.820	3.9	33.8	Flood Risk
240 min Winter	99.775	0.775	3.8	31.9	Flood Risk
360 min Winter	99.687	0.687	3.5	28.3	O K
480 min Winter	99.610	0.610	3.2	25.2	O K
600 min Winter	99.544	0.544	3.0	22.4	O K
720 min Winter	99.486	0.486	2.9	20.0	O K
960 min Winter	99.390	0.390	2.6	16.1	O K
1440 min Winter	99.251	0.251	2.1	10.4	O K
2160 min Winter	99.121	0.121	1.7	5.0	O K
2880 min Winter	99.051	0.051	1.5	2.1	O K
4320 min Winter	99.037	0.037	1.1	1.5	O K
5760 min Winter	99.029	0.029	0.9	1.2	O K
7200 min Winter	99.025	0.025	0.8	1.0	O K
8640 min Winter	99.022	0.022	0.7	0.9	O K
10080 min Winter	99.019	0.019	0.6	0.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	96.128	0.0	31
60 min Winter	60.976	0.0	58
120 min Winter	35.766	0.0	94
180 min Winter	26.043	0.0	134
240 min Winter	20.765	0.0	172
360 min Winter	15.082	0.0	244
480 min Winter	12.031	0.0	314
600 min Winter	10.101	0.0	384
720 min Winter	8.758	0.0	450
960 min Winter	6.997	0.0	580
1440 min Winter	5.108	0.0	836
2160 min Winter	3.727	0.0	1192
2880 min Winter	2.977	0.0	1472
4320 min Winter	2.165	0.0	2200
5760 min Winter	1.726	0.0	2936
7200 min Winter	1.454	0.0	3552
8640 min Winter	1.261	0.0	4312
10080 min Winter	1.115	0.0	5104

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 556538 166708 TQ 56538 66708
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.088

Time (mins) From:	To:	Area (ha)
0	4	0.088

Model Details

Storage is Online Cover Level (m) 100.000

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.03600	Trench Width (m)	0.9
Infiltration Coefficient Side (m/hr)	0.03600	Trench Length (m)	152.7
Safety Factor	1.0	Slope (1:X)	0.0
Porosity	0.30	Cap Volume Depth (m)	1.000
Invert Level (m)	99.000	Cap Infiltration Depth (m)	1.000

Summary of Results for 100 year Return Period (+25%)

Half Drain Time : 235 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	99.174	0.874	5.8	96.0	O K
30 min Summer	99.429	1.129	6.5	124.0	O K
60 min Summer	99.666	1.366	7.1	149.9	O K
120 min Summer	99.753	1.453	7.3	159.5	Flood Risk
180 min Summer	99.746	1.446	7.3	158.7	Flood Risk
240 min Summer	99.724	1.424	7.2	156.3	Flood Risk
360 min Summer	99.669	1.369	7.1	150.3	O K
480 min Summer	99.612	1.312	6.9	144.0	O K
600 min Summer	99.558	1.258	6.8	138.2	O K
720 min Summer	99.510	1.210	6.7	132.8	O K
960 min Summer	99.420	1.120	6.5	123.0	O K
1440 min Summer	99.263	0.963	6.1	105.7	O K
2160 min Summer	99.064	0.764	5.6	83.9	O K
2880 min Summer	98.903	0.603	5.2	66.2	O K
4320 min Summer	98.661	0.361	4.6	39.7	O K
5760 min Summer	98.502	0.202	4.2	22.2	O K
7200 min Summer	98.403	0.103	3.9	11.3	O K
8640 min Summer	98.351	0.051	3.8	5.6	O K
10080 min Summer	98.345	0.045	3.4	4.9	O K
15 min Winter	99.284	0.984	6.1	108.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	145.215	0.0	18
30 min Summer	96.128	0.0	33
60 min Summer	60.976	0.0	62
120 min Summer	35.766	0.0	120
180 min Summer	26.043	0.0	166
240 min Summer	20.765	0.0	194
360 min Summer	15.082	0.0	260
480 min Summer	12.031	0.0	328
600 min Summer	10.101	0.0	398
720 min Summer	8.758	0.0	466
960 min Summer	6.997	0.0	606
1440 min Summer	5.108	0.0	868
2160 min Summer	3.727	0.0	1256
2880 min Summer	2.977	0.0	1640
4320 min Summer	2.165	0.0	2376
5760 min Summer	1.726	0.0	3056
7200 min Summer	1.454	0.0	3744
8640 min Summer	1.261	0.0	4400
10080 min Summer	1.115	0.0	5088
15 min Winter	145.215	0.0	18

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.574	1.274	6.8	139.8	O K
60 min Winter	99.846	1.546	7.5	169.8	Flood Risk
120 min Winter	99.964	1.664	7.8	182.7	Flood Risk
180 min Winter	99.972	1.672	7.8	183.6	Flood Risk
240 min Winter	99.942	1.642	7.8	180.3	Flood Risk
360 min Winter	99.879	1.579	7.6	173.4	Flood Risk
480 min Winter	99.804	1.504	7.4	165.1	Flood Risk
600 min Winter	99.726	1.426	7.2	156.5	Flood Risk
720 min Winter	99.653	1.353	7.0	148.6	O K
960 min Winter	99.520	1.220	6.7	134.0	O K
1440 min Winter	99.288	0.988	6.1	108.5	O K
2160 min Winter	99.010	0.710	5.4	77.9	O K
2880 min Winter	98.794	0.494	4.9	54.3	O K
4320 min Winter	98.496	0.196	4.2	21.5	O K
5760 min Winter	98.350	0.050	3.8	5.5	O K
7200 min Winter	98.342	0.042	3.2	4.6	O K
8640 min Winter	98.337	0.037	2.8	4.0	O K
10080 min Winter	98.332	0.032	2.4	3.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	96.128	0.0	32
60 min Winter	60.976	0.0	62
120 min Winter	35.766	0.0	118
180 min Winter	26.043	0.0	172
240 min Winter	20.765	0.0	220
360 min Winter	15.082	0.0	276
480 min Winter	12.031	0.0	354
600 min Winter	10.101	0.0	430
720 min Winter	8.758	0.0	506
960 min Winter	6.997	0.0	652
1440 min Winter	5.108	0.0	926
2160 min Winter	3.727	0.0	1324
2880 min Winter	2.977	0.0	1704
4320 min Winter	2.165	0.0	2420
5760 min Winter	1.726	0.0	2936
7200 min Winter	1.454	0.0	3648
8640 min Winter	1.261	0.0	4344
10080 min Winter	1.115	0.0	4984

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 556538 166708 TQ 56538 66708
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.370

Time (mins) From:	To:	Area (ha)
0	4	0.370

Model Details

Storage is Online Cover Level (m) 100.000

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.03600	Trench Width (m)	3.0
Infiltration Coefficient Side (m/hr)	0.03600	Trench Length (m)	122.0
Safety Factor	1.0	Slope (1:X)	0.0
Porosity	0.30	Cap Volume Depth (m)	1.700
Invert Level (m)	98.300	Cap Infiltration Depth (m)	1.700

Appendix C – Surface Water Drainage Strategy Drawing

Impermeable Area: 0.029ha
Assumed Infiltration Rate: 0.036m/hr
Gravel Trench Length: 64.4m
Gravel Trench Width: 0.6m
Gravel Trench Depth: 1.0m

Impermeable Area: 0.058ha
Assumed Infiltration Rate: 0.036m/hr
Gravel Trench Length: 97.2m
Gravel Trench Width: 0.9m
Gravel Trench Depth: 1.0m

N

Key:

Gravel Trench

Notes:

1. Drawing provided for information purposes only, not to be used for construction or costing.
2. Pegasus Group take no responsibility for the misuse of this drawing.

REV	DATE	DESCRIPTION	REVISED BY	APPROVED BY
P3	23.10.23	SITE LAYOUT UPDATES	MR	LJ
P2	13.09.23	UPDATES	MR	LJ
P1	04.09.23	FIRST ISSUE	LG	LJ

DRAINAGE STRATEGY DRAWING SHEET 1

CHIMMENS SOLAR

CLIENT:
RES Ltd

DATE:	SCALE:	TEAM/DRAWN BY:	APPROVED BY:
04/09/2023	1:1000	LG	LAJ

DRAWING NUMBER:
P22-1221 - PEG - XX - XX - DR - C - 2000 - P3

PEGASUS REF No:	DRAWING STATUS
P22-1221	SO

PEGASUS GROUP

Impermeable Area: 0.058ha
Assumed Infiltration Rate: 0.036m/hr
Gravel Trench Length: 97.2m
Gravel Trench Width: 0.9m
Gravel Trench Depth: 1.0m

Impermeable Area: 0.088ha
Assumed Infiltration Rate: 0.036m/hr
Gravel Trench Length: 152.7m
Gravel Trench Width: 0.9m
Gravel Trench Depth: 1.0m

Impermeable Area: 0.029ha
Assumed Infiltration Rate: 0.036m/hr
Gravel Trench Length: 64.4m
Gravel Trench Width: 0.6m
Gravel Trench Depth: 1.0m

N

Key:

Gravel Trench

Notes:

1. Drawing provided for information purposes only, not to be used for construction or costing.
2. Pegasus Group take no responsibility for the misuse of this drawing.

REV	DATE	DESCRIPTION	REVISED BY	APPROVED BY
P1	23.10.23	SITE LAYOUT UPDATES	MR	LJ

DRAINAGE STRATEGY DRAWING SHEET 2

CHIMMENS SOLAR

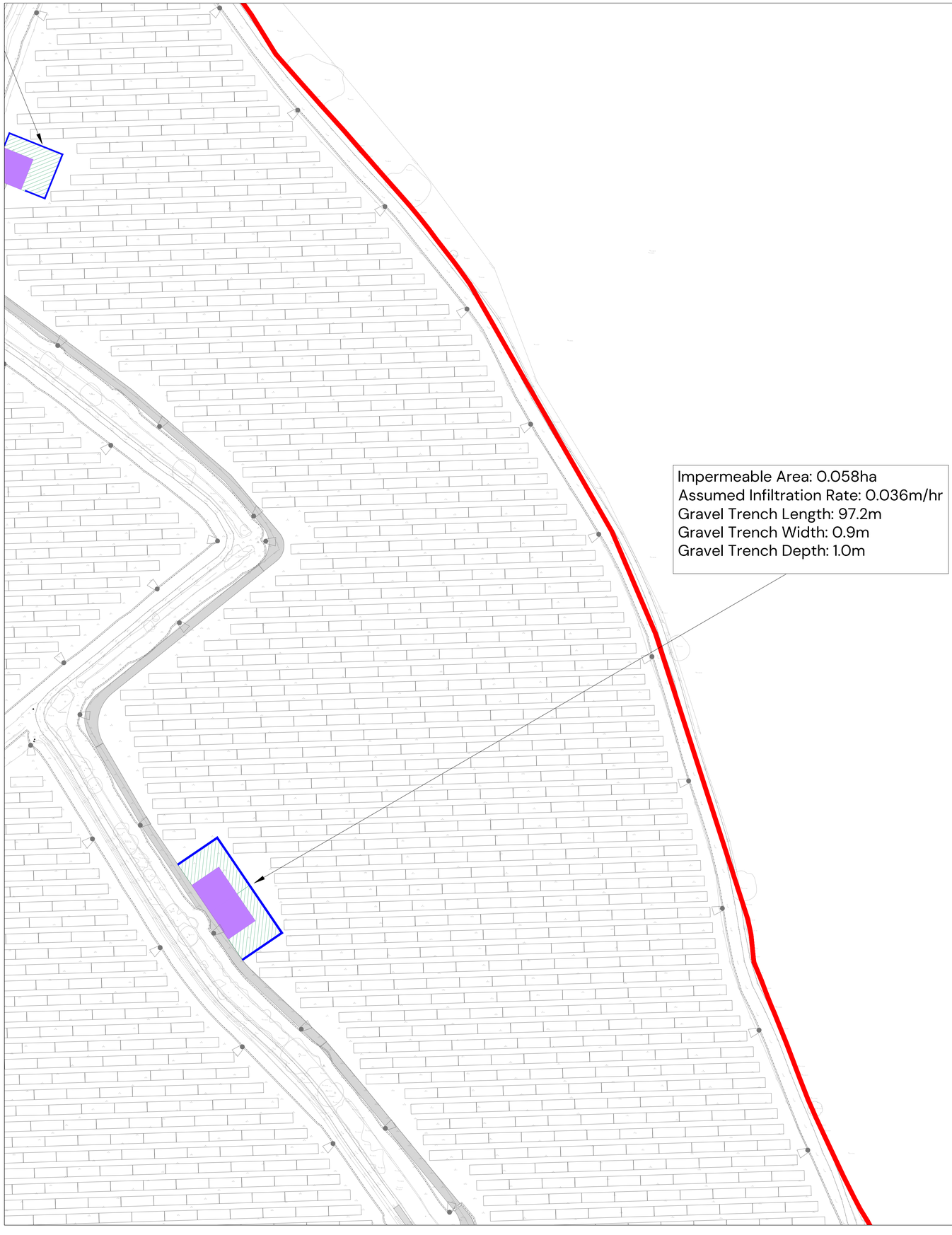
CLIENT:
RES Ltd

DATE:	SCALE:	TEAM/DRAWN BY:	APPROVED BY:
23/10/2023	1:1000	MR	LAJ

DRAWING NUMBER:
P22-1221 - PEG - XX - XX - DR - C - 2001 - P1

PEGASUS REF No:	DRAWING STATUS
P22-1221	S0

PEGASUS GROUP



N

Key:

Gravel Trench

Notes:

1. Drawing provided for information purposes only, not to be used for construction or costing.
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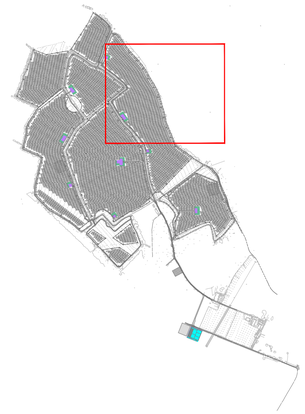


REV	DATE	DESCRIPTION	REVISED BY	APPROVED BY
P1	23.10.23	SITE LAYOUT UPDATES	MR	LJ

DRAINAGE STRATEGY DRAWING SHEET 3

CHIMMENS SOLAR

CLIENT:
RES Ltd

DATE:	SCALE:	TEAM/DRAWN BY:	APPROVED BY:
23/10/2023	1:1000	MR	LAJ

DRAWING NUMBER:
P22-1221 - PEG - XX - XX - DR - C - 2002 - P1

PEGASUS REF No:	DRAWING STATUS
P22-1221	S0

PEGASUS GROUP

Impermeable Area: 0.029ha
Assumed Infiltration Rate: 0.036m/hr
Gravel Trench Length: 64.4m
Gravel Trench Width: 0.6m
Gravel Trench Depth: 1.0m

Impermeable Area: 0.058ha
Assumed Infiltration Rate: 0.036m/hr
Gravel Trench Length: 97.2m
Gravel Trench Width: 0.9m
Gravel Trench Depth: 1.0m

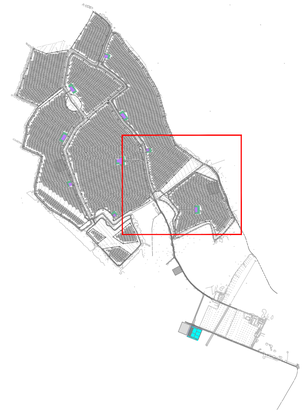
N

Key:

Gravel Trench

Notes:

1. Drawing provided for information purposes only, not to be used for construction or costing.
2. Pegasus Group take no responsibility for the misuse of this drawing.



REV	DATE	DESCRIPTION	REVISED BY	APPROVED BY
P1	23.10.23	SITE LAYOUT UPDATES	MR	LJ

DRAINAGE STRATEGY DRAWING SHEET 4

CHIMMENS SOLAR

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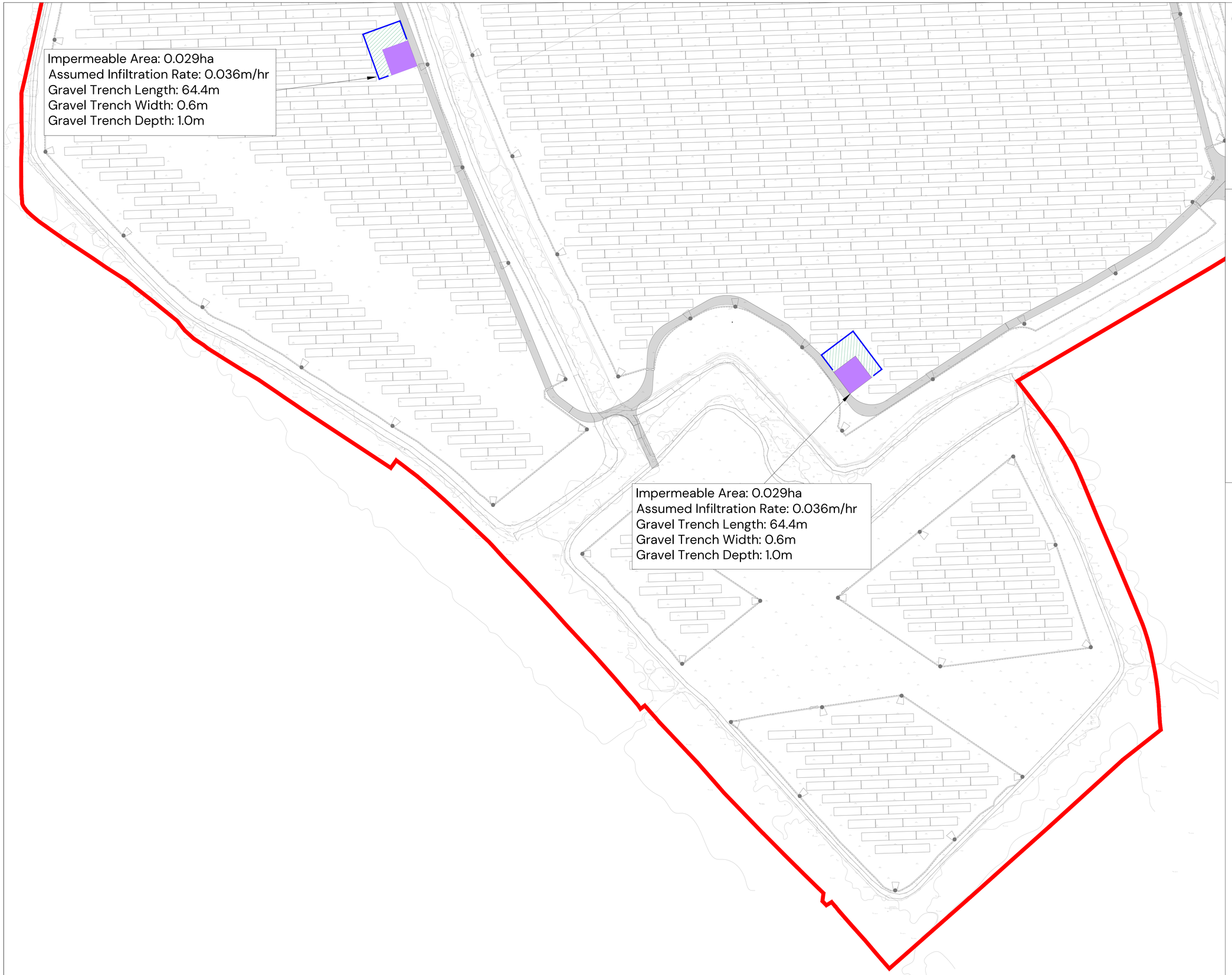
DATE:	SCALE:	TEAM/DRAWN BY:	APPROVED BY:
23/10/2023	1:1000	MR	LAJ

DRAWING NUMBER:
P22-1221 - PEG - XX - XX - DR - C - 2003 - P1

PEGASUS REF No:	DRAWING STATUS
P22-1221	SO

PEGASUS GROUP



N

Key:

Gravel Trench

Notes:

1. Drawing provided for information purposes only, not to be used for construction or costing.
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REV	DATE	DESCRIPTION	REVISED BY	APPROVED BY
P1	23.10.23	SITE LAYOUT UPDATES	MR	LJ

DRAINAGE STRATEGY DRAWING SHEET 5

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23/10/2023	1:1000	MR	LAJ

DRAWING NUMBER:
P22-1221 - PEG - XX - XX - DR - C - 2004 - P1

PEGASUS REF No:	DRAWING STATUS
P22-1221	S0

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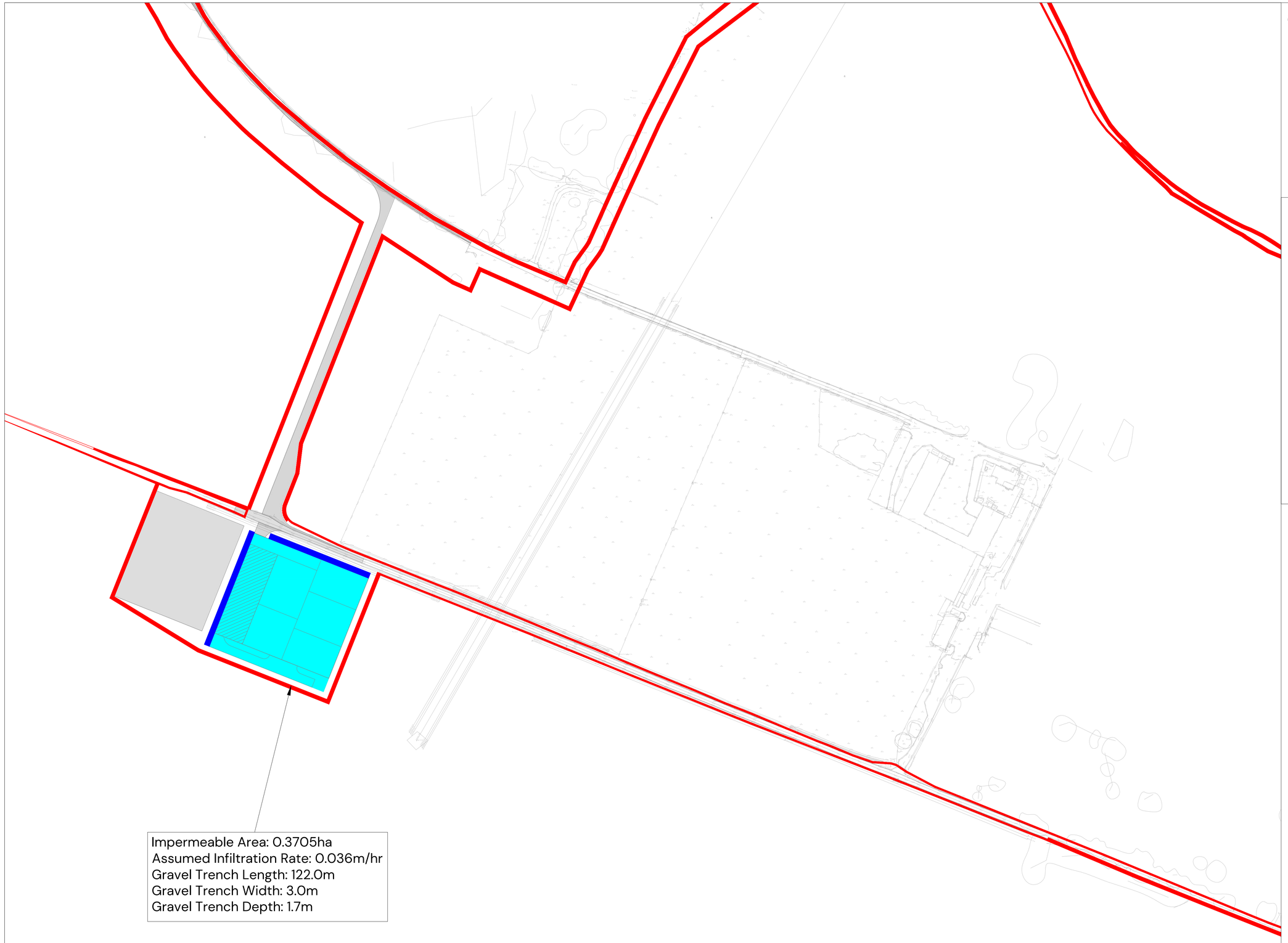

N

Key:

Gravel Trench

Notes:

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REV	DATE	DESCRIPTION	REVISED BY	APPROVED BY
P3	30.10.23	INFILTRATION TRENCH UPDATE	MR	LG
P2	27.10.23	INFILTRATION TRENCH UPDATE	MR	LG
P1	23.10.23	SITE LAYOUT UPDATES	MR	LJ

DRAINAGE STRATEGY DRAWING SHEET 6

CHIMMENS SOLAR

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DATE:	SCALE:	TEAM/DRAWN BY:	APPROVED BY:
23/10/2023	1:1000	MR	LAJ

DRAWING NUMBER:
P22-1221 - PEG - XX - XX - DR - C - 2005 - P3

PEGASUS REF No:	DRAWING STATUS
P22-1221	S0

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N

Key:

Gravel Trench

Notes:

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REV	DATE	DESCRIPTION	REVISED BY	APPROVED BY
P1	23.10.23	SITE LAYOUT UPDATES	MR	LJ

DRAINAGE STRATEGY DRAWING SHEET 7

CHIMMENS SOLAR

CLIENT:
RES Ltd

DATE:	SCALE:	TEAM/DRAWN BY:	APPROVED BY:
23/10/2023	1:1000	MR	LAJ

DRAWING NUMBER:
P22-1221 - PEG - XX - XX - DR - C - 2006 - P1

PEGASUS REF No:	DRAWING STATUS
P22-1221	SO

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