voltalia

Technical Appendix 9.1: Outline Surface Water Drainage Strategy

Department: ERM
Project: Bowshiel Solar Farm and BESS
Document Code: 0733784

May 2025

INDEX

1 INTRODUCTION

1.1 Purpose of This Report

1.1.1.1 Voltalia UK Ltd. (Voltalia) is proposing to construct and operate a ground-mounted solar photovoltaic ('PV') development with a generating capacity of approximately up to 165 Megawatts (MW), Battery Energy Storage System ('BESS') with a generating capacity of approximately up to 80 MW, associated infrastructure, access, and landscaping, henceforth referred to as 'the Proposed Development'.

1.1.1.2 The Proposed Development is located on land approximately 2.4 kilometres (km) south of the village of Cockburnspath at the closest point to the Proposed Development boundary ('the Site').

1.1.1.3 Environmental Resources Management Limited (ERM) has been commissioned by Voltalia (the Applicant) to undertake an Outline Surface Water Drainage Strategy (OSWDS) for the construction of the Bowshiel Solar Farm and BESS.

1.1.1.4 This Outline Surface Water Drainage Strategy is a Technical Appendix to **Chapter 9: Water Resources and Flood Risk.**

1.1.1.5 The Proposed Development includes a range of infrastructure which varies in footprint and permeability. To effectively manage surface water runoff for the different types of infrastructure, this Outline Surface Water Drainage Strategy details the proposed surface water management measures for different elements of the Proposed Development in accordance with the footprint and permeability of the infrastructure.

1.1.1.6 The measures within this OSWDS will inform the detailed design of the surface water drainage measures which will be produced prior to the construction phase.

1.1.1.7 **Section 4.1** and **Section 4.2** outline the surface water drainage methodology for the PV arrays, and the BESS and substation compound respectively.

1.2 Policy and Guidance

1.2.1.1 This Outline Surface Water Drainage Strategy has been produced in accordance with the following guidance:

- The National Planning Framework ('NPF') 4, 2023[1];
- Scottish Environment Protection Agency's (SEPA) Regulatory Method: Sustainable Urban

[1] Scottish Government (2023). National Planning Policy 4. Available online at: https://www.gov.scot/publications/national-planning-framework-4/ Accessed 16/04/2025.

- Drainage Systems, 2019[2];
- Sustainable Urban Drainage Scottish Working Party's (SUDSWP) Water Assessment and Drainage Assessment Guide, 2016[3];
- The CIRIA SuDS Manual, 2015[4];
- The General Binding Rules 10, 11 and 21 of the Water Environment (Controlled Activities)
- (Scotland) Regulations 2011[5];
- SEPA's Guidance Note 2: Planning advice on Sustainable Drainage Systems (SuDS), 2010[6];
- The Flood Risk Management (Scotland) Act 2009[7];
- The Flood Risk Management (Scotland) Act 2009: Surface Water Management Planning Guidance 2018[8];
- Scottish Borders Council. SuDS Supplementary Planning Guidance[9];
- Scottish Borders Strategic Flood Risk Assessment[10].

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[2] SEPA (2019). Regulatory Method: SuDS. Available online at: https://www.sepa.org.uk/media/219048/wat-rm-08-regulation-of-sustainable-urban-drainage-systems-suds.pdf Accessed 16/04/2025.
[3] SuDS Working Party (2016). Water Assessment and Drainage Assessment Guide. Available online at: https://www.sepa.org.uk/media/163472/water_assessment_and_drainage_assessment_guide.pdf Accessed: 16/04/2025
[4] CIRIA (2015). The SuDS Manual C753. Available online at: https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductCode=C753 Accessed 16/04/2025.
[5] Scottish Government (2021). The Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2021. Available online at: https://www.legislation.gov.uk/ssi/2021/412/contents/made Accessed: 16/04/2025
[6] SEPA (2010). Land Use Planning System SEPA Guidance Note 2: Planning Advice on SuDS. Available online at: https://geosmartinfo.co.uk/wp-content/uploads/2023/01/lups-gu2-planning-guidance-on-sustainable-drainage-systems-suds.pdf Accessed: 16/04/2025
[7] Scottish Government (2009). Flood Risk Management (Scotland) Act 2009. Available online at: https://www.legislation.gov.uk/asp/2009/6/contents Accessed 16/04/2025.
[8] Scottish Water, SEPA and Scottish Government (2018). Flood Risk Management Act (Scotland) 2009: Surface Water Management Planning Guidance. Available online at: https://www.gov.scot/publications/flood-risk-management-scotland-act-2009-surface-water-management-planning/documents/ Accessed 16/04/2025.
[9] Scottish Borders Council (2020). SuDS Supplementary Planning Guidance. Available online at: https://www.scotborders.gov.uk/downloads/file/7022/sustainable_urban_drainage_-_draft_supplementary_planning_guidance.pdf Accessed 16/04/2025.
[10] Scottish Borders Council (2020). Strategic Flood Risk Assessment. Available online at: https://www.scotborders.gov.uk/downloads/file/7558/strategic_flood_risk_assessment.pdf Accessed 14/04/2025.

1.2.1.2 National Planning framework 4 (NPF4)[11] states that "Development proposals will not increase the risk of surface water flooding to others, or itself be at risk" with "proposals at risk of flooding or in a flood risk area only supported if they are:

- Essential infrastructure where the location is required for operational reasons;
- Water compatible uses;
- Redevelopment of an existing building or site for an equal or less vulnerable use; or
- Development of previously used sites in built up areas where the LDP has identified a need to bring these into positive use and where proposals demonstrate that long term safety and resilience can be secured in accordance with relevant Scottish Environmental Protection Agency (SEPA) advice."

1.2.1.3 NPF4 is supplemented by the following guidance documents that have been considered in the authoring of this OSWDS:

- Scottish Government Flood Risk Planning Advice[12];
- SEPA Guidance Note: Technical Flood Risk Guidance for Stakeholders[13];
- Construction Industry Research and Information Association (CIRIA) Guidance Document C624: Development and Flood Risk[14];
- SEPA Flood Modelling Guidance for Responsible Authorities[15]; and
- SEPA: Climate change allowances for flood risk assessment in land use planning[16].

[11] Scottish Government (2024). National Planning framework 4. Available online at: https://www.gov.scot/publications/national-planning-framework-4/documents/ Accessed 14/04/2025

[12] Scottish Government (2015). Flood Risk: Planning Avice. Available online at: https://www.gov.scot/publications/flood-risk-planning-advice/ Accessed 14/04/2025.

[13] SEPA (2022). Technical Flood Risk Guidance for Stakeholders. Available online at: https://www.sepa.org.uk/media/162602/ss-nfr-p-002-technical-flood-risk-guidance-for-stakeholders.pdf Accessed 14/04/2025

[14] CIRIA (2004). Development and Flood Risk – Guidance for the Construction Industry. Available online at: https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductCode=C624 Accessed 14/04/2025

[15] SEPA. Flood Modelling Guidance for Responsible Authorities. Available online at: https://www.sepa.org.uk/media/219653/flood_model_guidance_v2.pdf

[16] SEPA (2024). Climate Change Allowances for Flood Risk Assessment in Land Use Planning. Available online at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.sepa.org.uk%2Fmedia%2Ftx2hrn51%2Fclimate-change-allowances-guidance-1.docx&wdOrigin=BROWSELINK Accessed 14/04/2025.

2 PROPOSED DEVELOPMENT

2.1 Development Description

2.1.1.1 The Proposed Development comprises a solar powered energy generating station, including a co-located Battery Energy Storage System (BESS). The Proposed Development will have a generating capacity of up to approximately 165 MW from the solar PV modules (solar panels), while the BESS will have a generating capacity of up to approximately 80 MW.

2.1.1.2 A full description of the components of the Proposed Development is provided in **Chapter 3: Development Description** and are shown in **Volume 2A, Figure 3.1: Site Layout Plan.** However, the principal components of the Proposed Development for the purposes of this report are as follows:

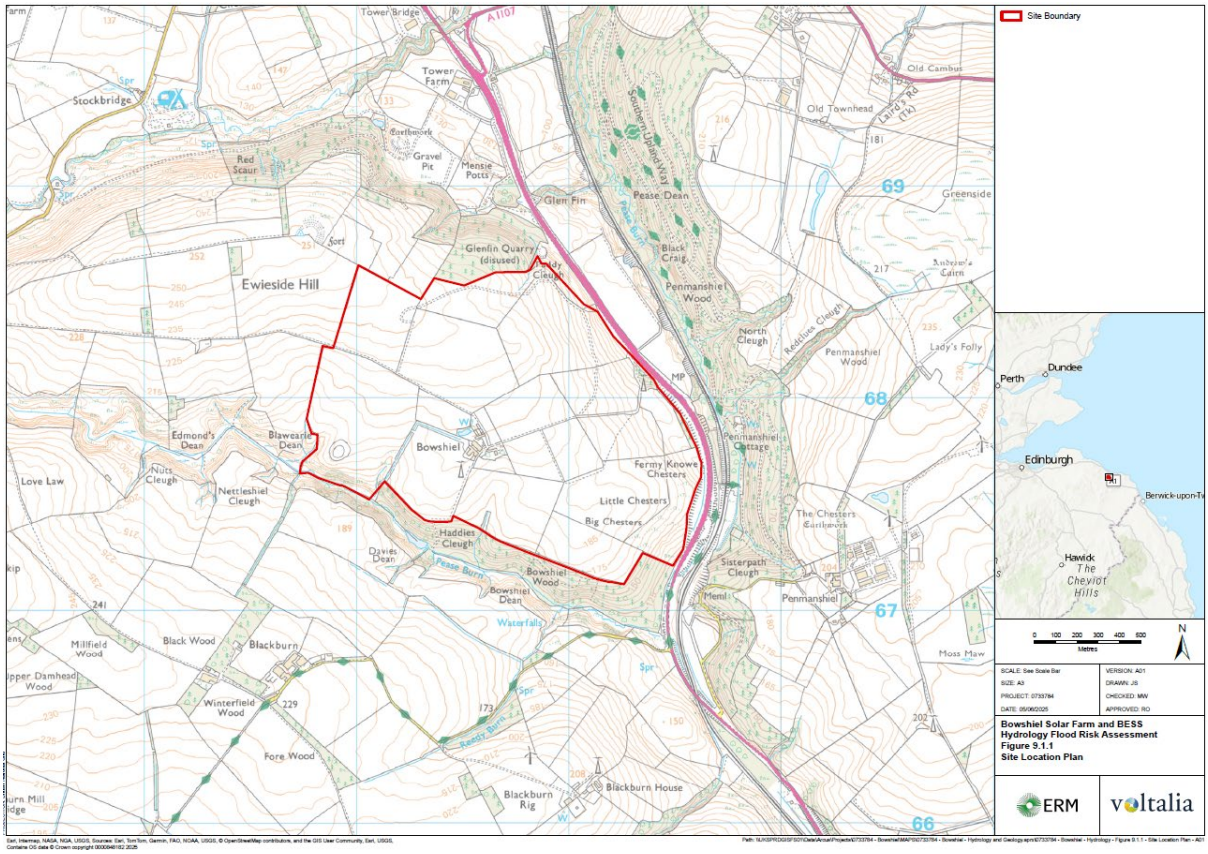
- Solar PV Arrays;
- Central Inverters;
- BESS;
- Substation Electrical Infrastructure; and
- Access tracks.

3 EXISTING SITE

3.1 Site Location

3.1.1.1 The Site is located on land approximately 2.4 kilometres (km) south of the village of Cockburnspath at the closest point to the Proposed Development boundary as shown in **Figure 9.1.1**.

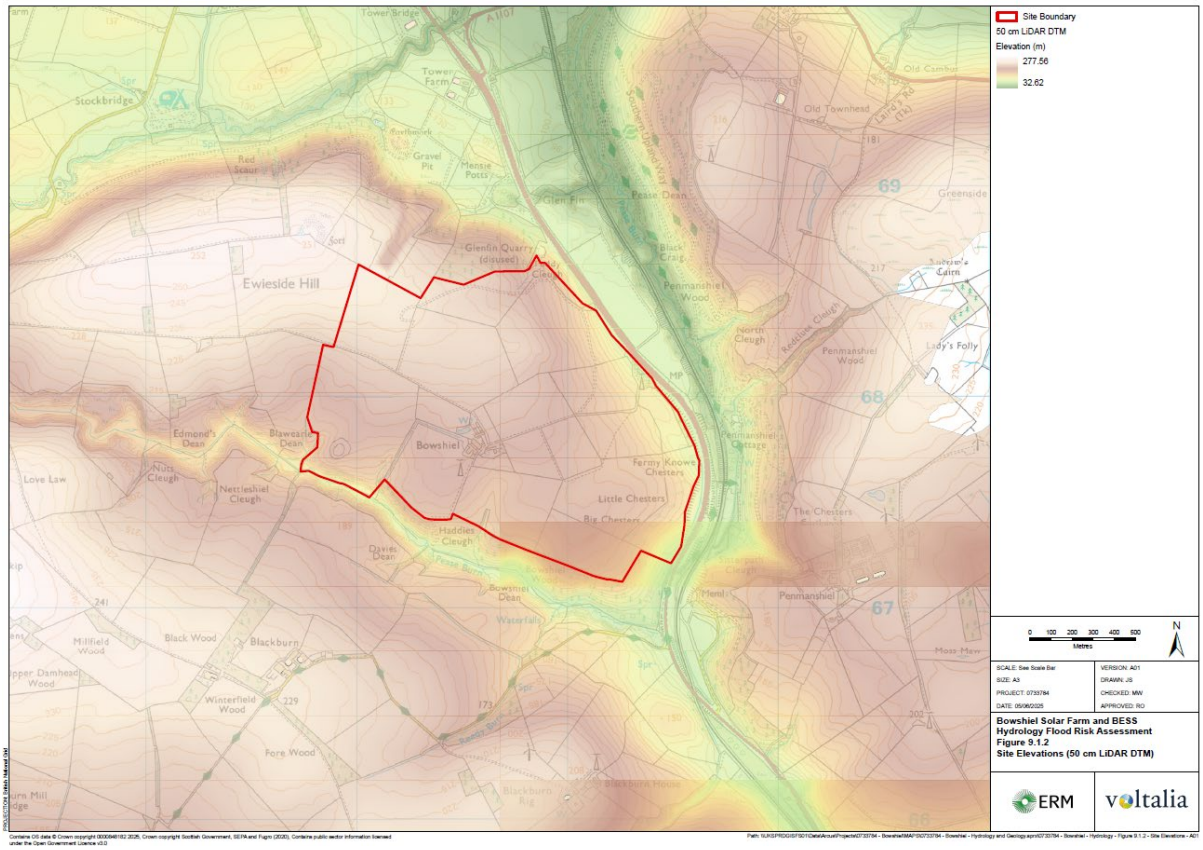
FIGURE 9.1.1 SITE LOCATION PLAN



3.2 Elevations

3.2.1.1 Light Detection and Ranging (LiDAR) data (2022) at 50 cm resolution identifies that the Site elevation range from 230 mAOD to 160 mAOD, predominantly north to south, with elevations across the Site shown in **Figure 9.1.2**

FIGURE 9.1.2 SITE ELEVATIONS



3.3 Hydrological Setting

3.3.1.1 The south of the Site is drained by two unnamed tributaries of the Pease Burn (**Volume 2a**, **Figure 9.2**). One burn originates by the farmhouse and discharges into the Pease Burn which flows east along the southern boundary of the Site, discharging into the main stem of the Pease Burn approximately 300 m southeast of the Site. The second burn originates in the centre of the field approximately 300 m south of the farmhouse and also flows south and into the Pease Burn.

3.3.1.2 The main stem of the Pease Burn flows north along the eastern boundary of the Site where it ultimately discharges into the Firth of Forth approximately 2.5 km downstream of the Site.

3.3.1.3 Another small unnamed burn flows north from the Site. It discharges into another unnamed burn before linking with the main stem of the Pease Burn.

4 OUTLINE SURFACE WATER DRAINAGE STRATEGY

4.1 PV Array Surface Water Drainage

4.1.1 PV Array Surface Water Runoff

4.1.1.1 The PV Array will comprise rows of solar panel modules mounted on metal frames and pile driven into the ground to limit the footprint of PV array units. The panels would be mounted at approximately 0.7 to 0.9 m (depending on conditions) from the ground at the lowest point rising to up to no more than 3.2 m at the highest point.

4.1.1.2 Installation of the PV arrays does not involve the introduction of hardstanding at ground level meaning the superficial cover for the majority of the Site will remain the same as the baseline. Additionally, the PV array tables will have regular rainwater gaps to prevent water being concentrated along a single drip line. As such, rainfall landing on the solar panels will drain through rainwater gaps and infiltrate into the ground beneath and between each row of panels.

4.1.1.3 The PV arrays have the potential to concentrate rainfall under the drip line leading to channelization and compaction of soils which can establish preferential flow routes for surface water in extreme events.

4.1.1.4 Research in the United States by Cook & McCuen[17] outlines that solar panels do not have a significant effect on runoff volumes or peak flows however where ground beneath panels is bare there may be an increase in peak discharge. Other research studies quantified this increase ranging from 1.5 % to 8.6 %, depending on site specific parameters.

4.1.1.5 The raised nature of PV Arrays will not prevent soil from absorbing rainwater as the panels will not be placed directly on the ground and each PV Row will be separated, with the same area of soil available for infiltration as per the baseline scenario.

4.1.1.6 Once rainfall has fallen off a PV Array, the water will be able to spread and flow along the ground under the PV Arrays evenly into the rain-shadow of the row below, so as to mobilise the same percentage of the ground for infiltration as was available prior to the installation of PV Arrays.

4.1.1.7 Water will drip off each PV Module with small gaps between modules. This means that the surface area to drip line length ratio will be the same as for "traditional" solar array layouts which use the same modules.

4.1.1.8 The energy of the flow which drains from PV Arrays will be greater than that of the rainfall. Therefore, this could result in erosion under the driplines and possibly lead to ground instability. In addition, intensification of the runoff from panels, along the 'drip line', into small channels / rivulets, could be exacerbated where PV Arrays are not positioned in alignment with topography. In order to avoid increased erosion rates, the grass beneath the

[17] Cook, Lauren & McCuen, Richard. (2013). Hydrologic Response of Solar Farms. Journal of Hydrologic Engineering. 18. 536-541. 10.1061/(ASCE)HE.1943-5584.0000530.

panels would be well maintained throughout the lifetime of the Proposed Development. During the operational phase the likelihood of soil erosion occurring as a result of the Development is therefore assessed to be minimal.

4.1.1.9 During the construction phase, unnecessary soil disturbance on saturated soils would be avoided in order to minimise soil compaction. As such the area under the drip line should be seeded with a suitable grass mix, to prevent rilling (incisions in soil caused by concentrated water flow) and an increase in surface water runoff rates.

4.1.1.10 All internal access tracks will be made up of a permeable aggregate (type 2 aggregate or similar) which will be subject to a maintenance program in accordance with best practice maintenance for solar farms. As such it is assessed that internal tracks will not comprise of impermeable surfaces.

4.2 BESS Compound Surface Water Drainage

4.2.1 BESS Hardstanding Surfaces

4.2.1.1 The BESS compound is located on the north of the Pease Burn and will comprise of electrical infrastructure and container units set on top of concrete (or similar) plinths.

4.2.1.2 The units within the compound will be set on a concrete plinth up to 0.5 m in height, and underlain by a permeable gravel subbase (e.g., type 2, aggregate or similar) and a permeable mesh membrane up to a depth of 0.5 m, as detailed in **Appendix A** of this report.

4.2.1.3 A review of the BESS compound layout plans indicate that the total hardstanding surfaces which makes up the BESS compound are those detailed below.

TABLE 4.1 BESS COMPOUND HARDSTANDING SURFACES

INFRASTRUCTURE	TOTAL AREA (M^2)
Battery Containers (40 units)	520
PGC Power Conversion Unit (12 units)	712
Tesla Megapack (10 units)	240
Substation Control Unit (1 units)	1,170
Substation (1 unit)	14
Total m^2	2656
Total (ha)	0.27

4.2.2 Surface Water Discharge Method

4.2.2.1 In accordance with the drainage hierarchy within the SuDS Manual, infiltration as a means of surface water management has been assessed as a preferential solution.

4.2.2.2 The British Geological Survey (BGS) borehole records[18] indicate there are multiple borehole records located along the A1 immediately east of the Site, and approximately 400 m north of the Site. These scans indicate that underlying strata within the vicinity of the Site comprises of various clay-based soils. The National Soils Map of Scotland[19] indicates the soil types at the brown earths. As such it is unlikely that the discharge of surface water runoff by infiltration-based systems will be feasible as the primary method for surface water disposal from the Proposed Development. Whilst any proposed SuDS features should encourage infiltration, they will also require a positive outfall.

4.2.2.3 In accordance with the drainage hierarchy the next appropriate outfall for surface water drainage is to a surface watercourse. The site walkover survey completed as part of the hydrology chapter identified a network of surface water drains flowing from the field south of the BESS compound towards the Pease Burn. DTM elevation data at the Site indicates that the BESS compound drains in the direction of the surface watercourses, and as such it is assessed that the BESS compound can drain towards the network of surface watercourses and imitate the existing surface water flow paths at the Site.

4.2.3 Surface Water Runoff Rate

4.2.3.1 Greenfield runoff rates for the 0.27 hectares (ha) of hardstanding within BESS compound have been calculated using the Interim Code of Practice for SuDS (ICP SuDS)[20] method via Info Drainage Software with rates shown in **Table 4.2**.

TABLE 4.2 BESS COMPOUND EXISTING GREENFIELD RUNOFF RATES

RETURN PERIOD	FLOW (L/S)
Qbar (2-year)	0.9
30-year	1.7
100-year	2.4
200-year	2.7

[18] British Geological Survey. Borehole Records. Available online at: https://mapapps2.bgs.ac.uk/geoindex/home.html Accessed 17/04/2025
[19] Scotland's Environment. Scotland's Soils. Available online at: https://map.environment.gov.scot/Soil_maps/?layer=1 Accessed 16/04/2025
[20] SuDS Working Group (2004). Interim Code of Practice for SuDS. Available online at: https://www.susdrain.org/files/resources/other-guidance/nswg_icop_for_suds_0704.pdf Accessed 16/04/2025

4.2.4 Proposed Discharge Rates

4.2.4.1 In accordance Scottish Borders Council SuDS Supplementary Planning Guidance, the peak surface water runoff rate for greenfield developments should be restricted to the pre-development discharge rate, where reasonably practicable. However, the SuDS Working Party Water Assessment and Drainage Assessment Guide specify that the minimum discharge rate for any new development site be set at 5 l/s. As such, surface water discharge from the Proposed Development should be restricted to 5.0l/s.

4.2.5 Return Period Design

4.2.5.1 The proposed surface water drainage system should be designed to ensure that the post development runoff rate and volume does not exceed the pre-development greenfield runoff rate. As detailed in the previous section in accordance with the SuDS Working Party Water Assessment and Drainage Assessment Guide the discharge rate will be limited to 5.0l/s.

4.2.5.2 Formal on-site drainage should be provided up to the 1 in 30-year return period event and attenuation measures should be designed such that SuDS features will not surcharge during a 30-year return period rainfall event.

4.2.5.3 No flooding to property or critical roads should occur during the 1 in 200-year event, with all surface water during this event (with an 39% allowance for climate change, in accordance with SEPA climate change allowances[21]) contained on-site.

4.2.6 Surface Water Attenuation

4.2.6.1 The surface water attenuation volume will be provided within the underlying aggregate and permeable mesh. To calculate the area available the areas beneath the infrastructure and access roads have been discounted as providing attenuation volume, providing a total area available of for attenuation of approximately 4,400 m^2 (0.44 ha).

4.2.6.2 Stone surfacing will comprise a minimum 500 mm of unbound free-draining aggregate subbase and permeable mesh lining, which will allow storage of storm water.

4.2.6.3 Surface water will be channelled through the subbase network through a perforated piped system which will then connect to an outfall to the Bilsdean Burn. The piped system will include inspection chambers to facilitate maintenance programmes.

4.2.6.4 The free draining subbase has been designed in Info Drainage software utilising cellular storage with design details in accordance with the SuDS Manual guidelines for cellular storage.

4.2.6.5 The porosity of a capping layer is defined by the type of fill material applied, with typical porosity values extracted from Info Drainage shown in **Table 4.3**. A conservative approach

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[21] SEPA. Climate Change Allowances for Flood Risk Assessments in Land Use Planning. Available online at: https://scottishepa.maps.arcgis.com/apps/webappviewer/index.html?id=2ddf84e295334f6b93bd0dbbb9ad7417 Accessed 16/04/2025

has been taken for the porosity value in order to assess a scenario where storage within the sub-base is limited, and as such a porosity value of 0.2 has been applied within the design of the structure (i.e., the lowest range within the graded gravel category).

4.2.6.6 In order to restrict surface water flows to 5 l/s a HydroBrake (or other flow restricting device) will be placed on the outfall of the pipes from the subbase.

TABLE 4.3 TYPICAL POROSITY VALUES

MATERIAL	POROSITY
Clean Stone	0.4 to 0.5
Uniform Gravel	0.3 to 0.4
Graded Sand or Gravel	0.2 to 0.3

4.2.6.7 The structure is shown to provide suitable attenuation capacity during the 1 in 200-year (+39 % climate change uplift) critical event with maximum rates calculated at 5 l/s, as shown in in **Appendix B** to this OSWDS. Due to the limited impermeable extents the surface water runoff and outfall rates generated are extremely low and flow rates leaving the system will be negligible demonstrating the porous nature of the Proposed Development.

4.2.6.8 During an exceedance event which exceeds the 1 in 200-year (+39% climate change uplift) event surface water flow routes will disperse as per the baseline scenario within the location of the BESS compound. The substation and compound are located within an agricultural catchment with no residential or manned property on-Site. Therefore, any exceedance will disperse within the extent of the Proposed Development, with no risk to people or the built environment.

4.2.7 Water Quality

4.2.7.1 In order to determine whether the proposed SuDS features for the Proposed Development will be sufficient at removing pollutants from surface water runoff, the CIRIA SuDS Manual (2015) Simple Index Approach has been applied, and is provided in **Appendix C** of this OSWDS. This approach provides pollution hazard levels and indices to relevant pollutants based upon contributing hardstanding surfaces.

4.2.8 Maintenance

4.2.8.1 The proposed surface water drainage system will require routine maintenance to ensure it remains fully operational and effective. The proposed SuDS features will remain under private ownership and should therefore, be maintained by either the Site owner or a suitable private management company.

4.2.8.2 Draft maintenance schedules for the proposed SuDS features have been provided in **Appendix D** of this OSWDS. However, a pre-commencement condition should be applied to

ensure a final Site-specific maintenance plan is provided post-consent for the proposed SuDS features.

5 RECOMMENDATIONS

5.1.1.1 The following outcomes of this OSWDS should be taken forward following the submission of the planning application for the Proposed Development prior to the detailed design stage:

- The design principles set out in this OSWDS will be incorporated into the detailed drainage design, which will be designed in accordance with The SuDS Manual, The Water Assessment and Drainage Assessment Guide, and Scottish Borders SuDS Supplementary Planning Guidance. The commitment to developing a detailed surface water drainage design in accordance with this guidance will be secured through an appropriately worded planning condition;

- Post-consent, a topographical survey of the Site should be completed which records the invert level and water level of the receiving watercourse. This will be required to inform the detailed drainage design of the Proposed Development;

- Following consultation with the local fire and rescue service a strategy should be developed to suitably control potentially contaminated fire water runoff; and

- A pre-commencement condition should be applied to ensure a final Site-specific maintenance plan is provided post-consent for the proposed SuDS features.

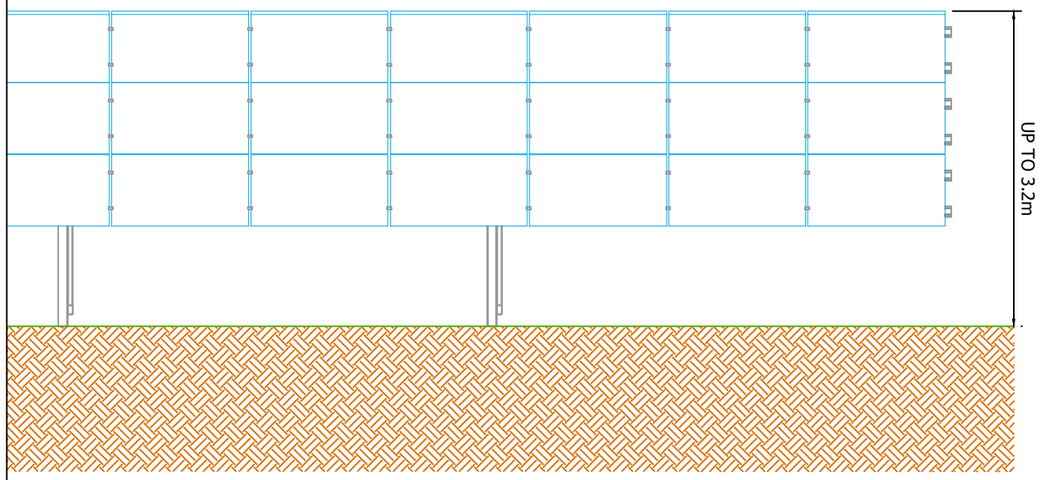
6 SUMMARY AND CONCLUSIONS

6.1.1.1 The PV Arrays will not result in an increase in hardstanding areas and therefore will not significantly increase surface water runoff rates. The PV Arrays will have multiple drip lines along the face to allow surface water to disperse evenly with native planting to be located beneath PV Arrays to preventing channelization and alterations to surface water flow routes.

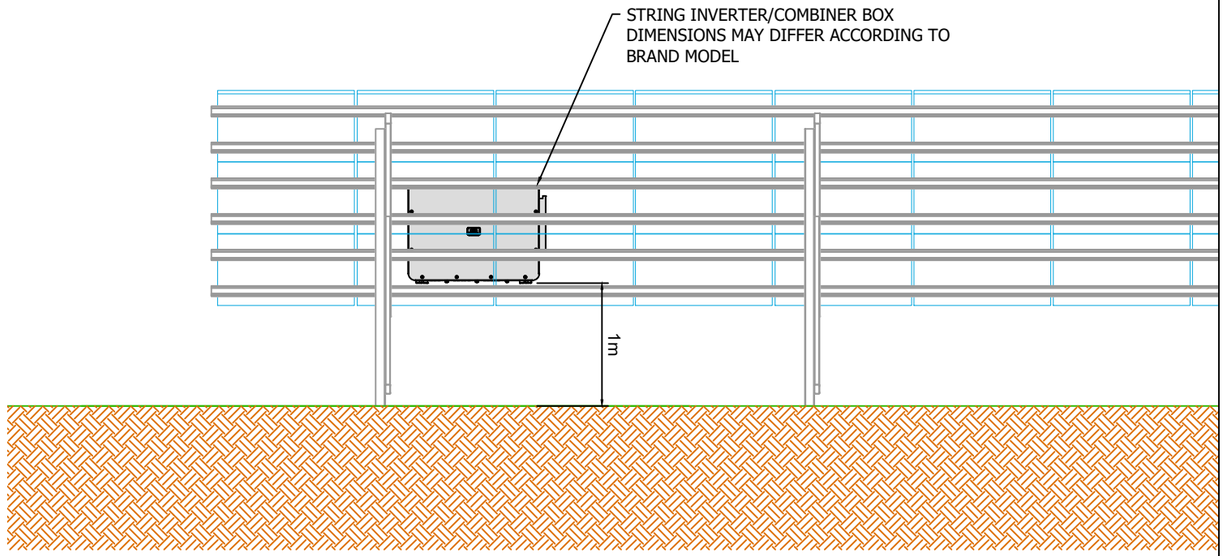
6.1.1.2 In order to maintain the discharge rate of 5.0l/s for all storms up to and including the 1 in 200-year return period with a 39% allowance for climate change, attenuation will be provided by utilising the underlying aggregate and permeable mesh base that sits beneath the BESS compound.

6.1.1.3 The drainage solution for the BESS compound would drain in accordance with existing Site elevations towards the network of surface watercourses south of the compound, which ultimately drain to Pease Burn.

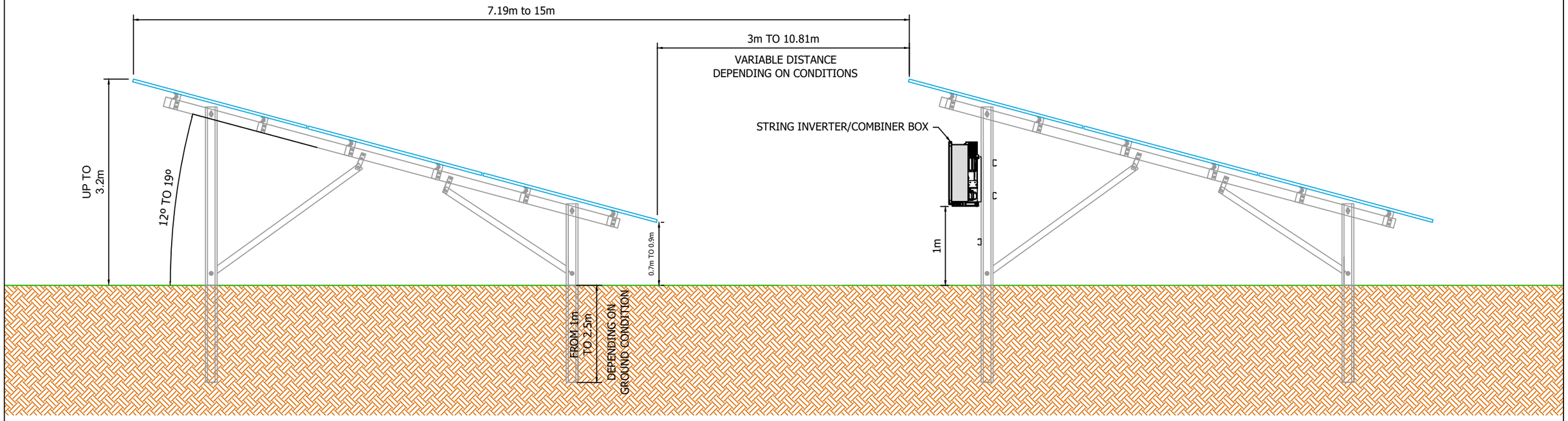
APPENDIX A –PLANNING ELEVATION DRAWINGS



FRONT VIEW



REAR VIEW



SIDE VIEW

Rev.	Date	Description	By	Chk

PROJECT TITLE:
BOWSHIEL SOLAR
BESS EIAR

CLIENT:
voltalia

DRAWING TITLE:
FIGURE 3.2
PV STRUCTURE
DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733784

SCALE @ A3:	APPROVED DATE:	DRAWING NUMBER:	REVISION:
1 : 50	12.03.25	DR_P_0008	-

Environmental Resources Management

ERM

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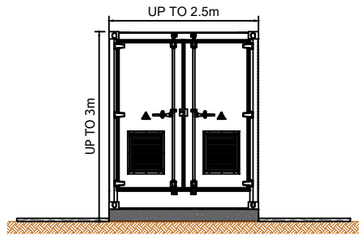

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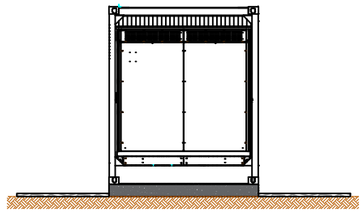

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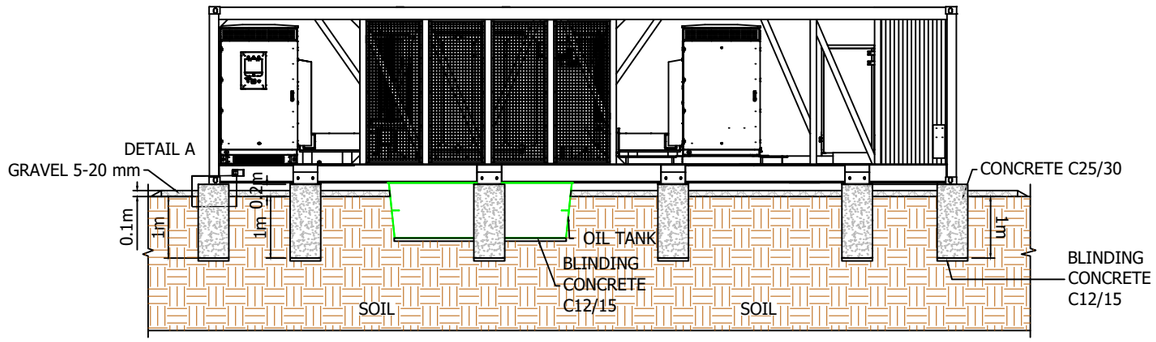
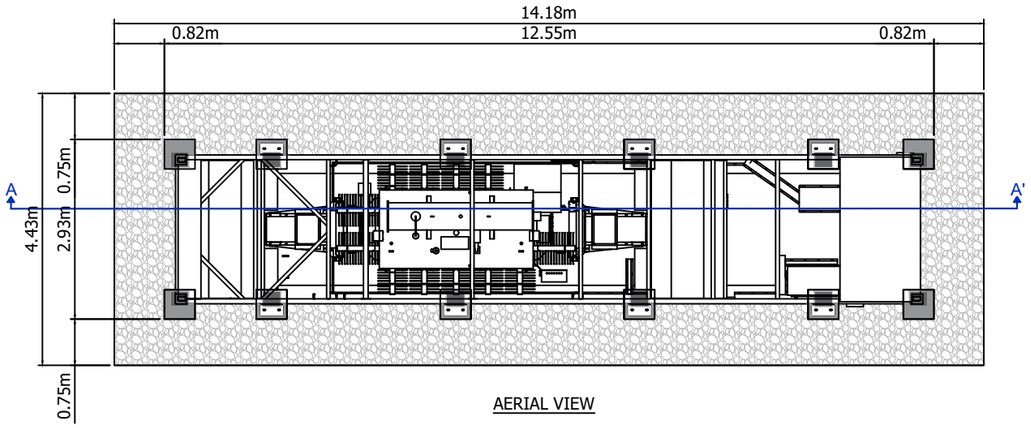
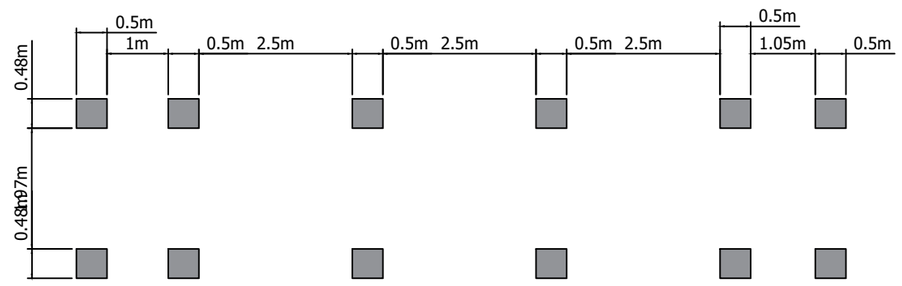


ELEVATION A-A'



AERIAL VIEW



FOUNDATIONS

Rev.	Date	Description	By	Chk

PROJECT TITLE: BOWSHIEL SOLAR BESS EIAR

CLIENT: voltalia

DRAWING TITLE: FIGURE 3.3 CENTRAL INVERTER DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733784

SCALE @ A3:	APPROVED DATE:	DRAWING NUMBER:	REVISION:
1 : 100	12.03.25	DR_P_0009	-

Environmental Resources Management

ERM

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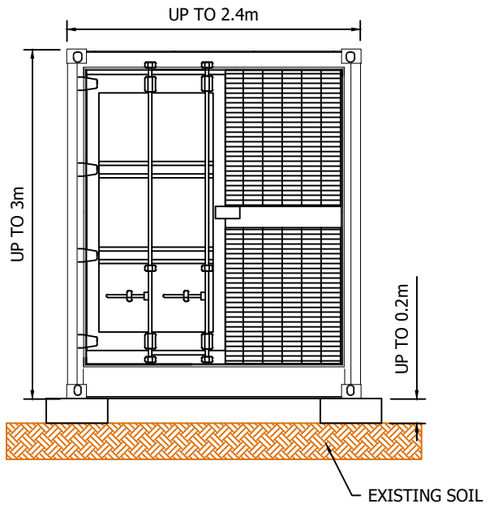
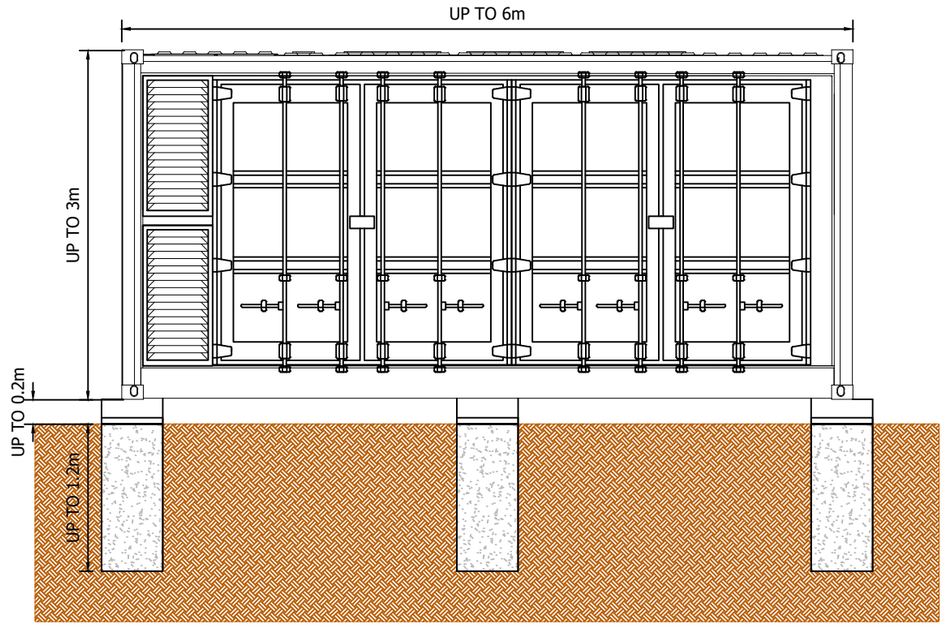


FRONT VIEW



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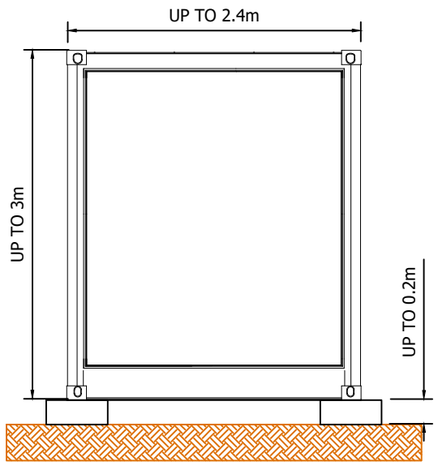

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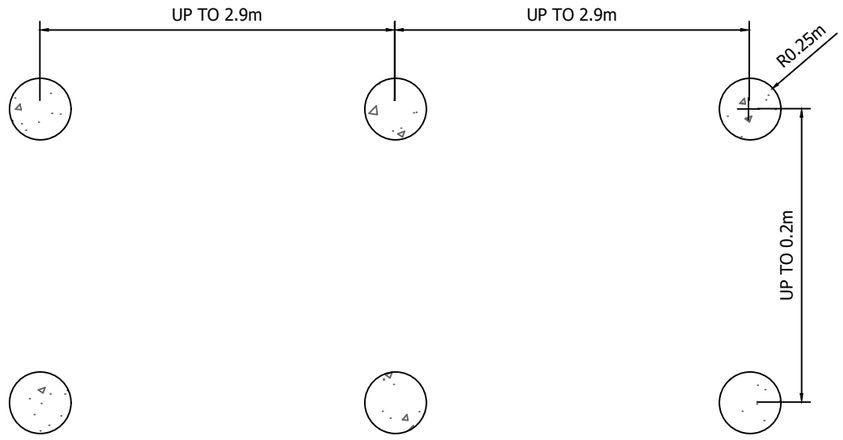


FOUNDATIONS

0 .5 1 1.5 2 2.5m

Y:\CAD\0733784_Bowshiel\01-Working\01_01-Drawings\BESS EIAR\0733784_DR_P_0004 - Battery Container Details.dwg

Rev.	Date	Description	By	Chk

PROJECT TITLE: BOWSHIEL SOLAR BESS EIAR

CLIENT: voltalia

DRAWING TITLE: FIGURE 3.4 BATTERY CONTAINER DETAILS

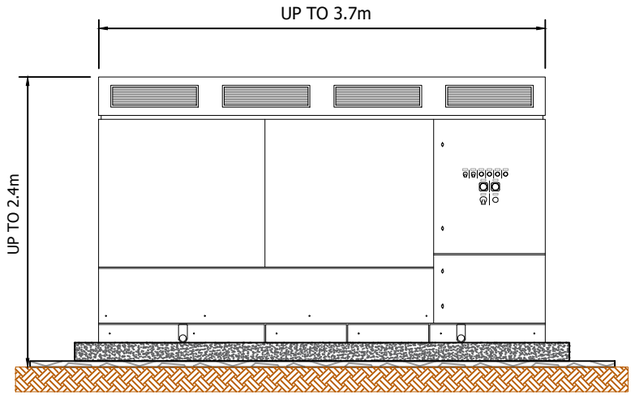
DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733784

SCALE @ A3:	APPROVED DATE:	DRAWING NUMBER:	REVISION:
1 : 50	17.03.25	DR_P_0004	-

Environmental Resources Management

ERM



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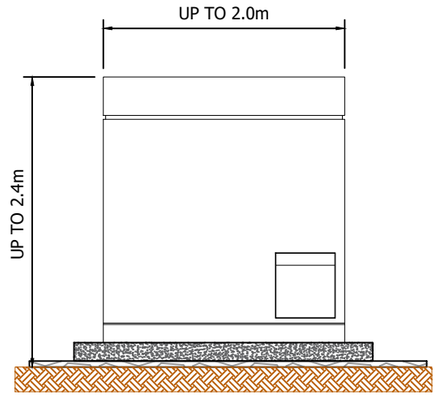

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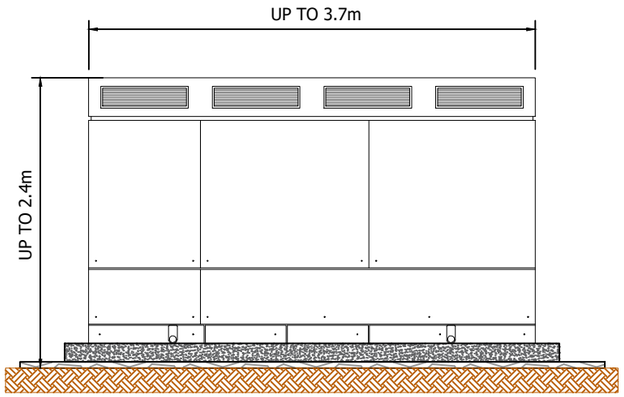

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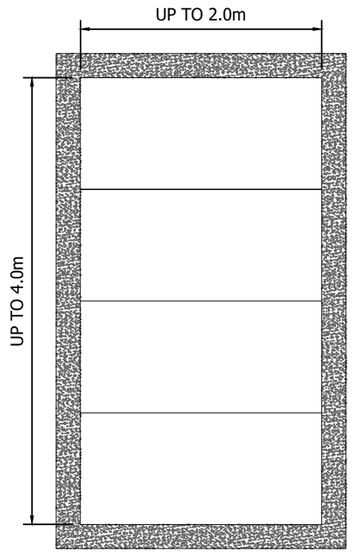
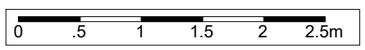


TOP VIEW



Rev.	Date	Description	By	Chk

PROJECT TITLE:
BOWSHIEL SOLAR
BESS EIAR

CLIENT:
voltalia

DRAWING TITLE:
FIGURE 3.5
POWER CONTROL
SYSTEM DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733784

SCALE @ A3:	APPROVED DATE:	DRAWING NUMBER:	REVISION:
1 : 50	17.03.25	DR_P_0003	-

Environmental Resources Management

ERM

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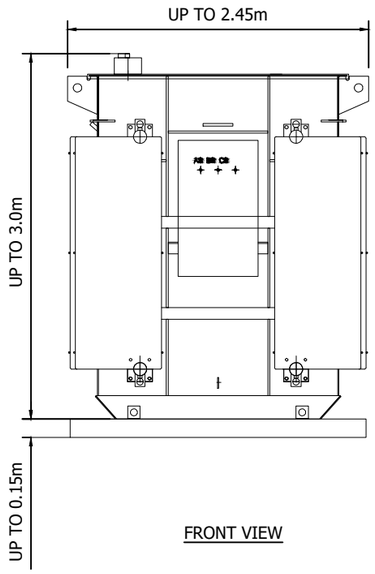

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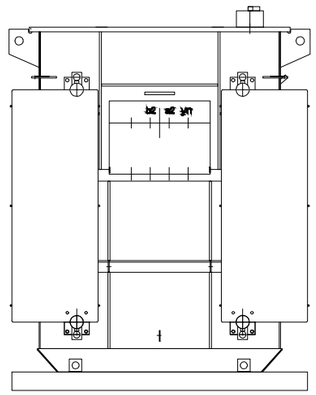

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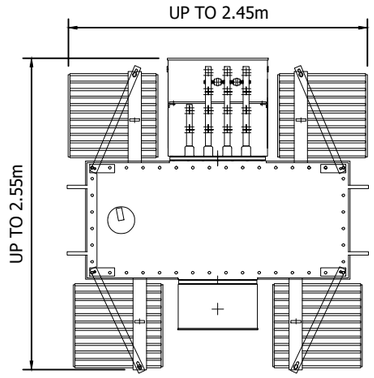
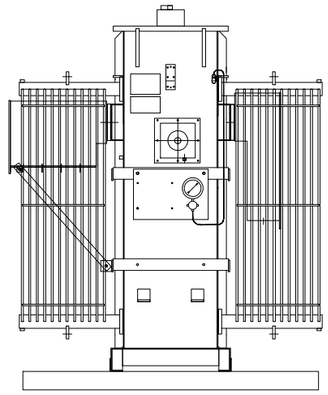


AERIAL VIEW



SIDE VIEW

0 .5 1 1.5 2 2.5m

Rev.	Date	Description	By	Chk

PROJECT TITLE:
BOWSHIEL SOLAR
BESS EIAR

CLIENT:
voltalia

DRAWING TITLE:
FIGURE 3.6
MV TRANSFORMER
DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733784

SCALE @ A3:	APPROVED DATE:	DRAWING NUMBER:	REVISION:
1 : 50	17.03.25	DR_P_0005	-

Environmental Resources Management

ERM

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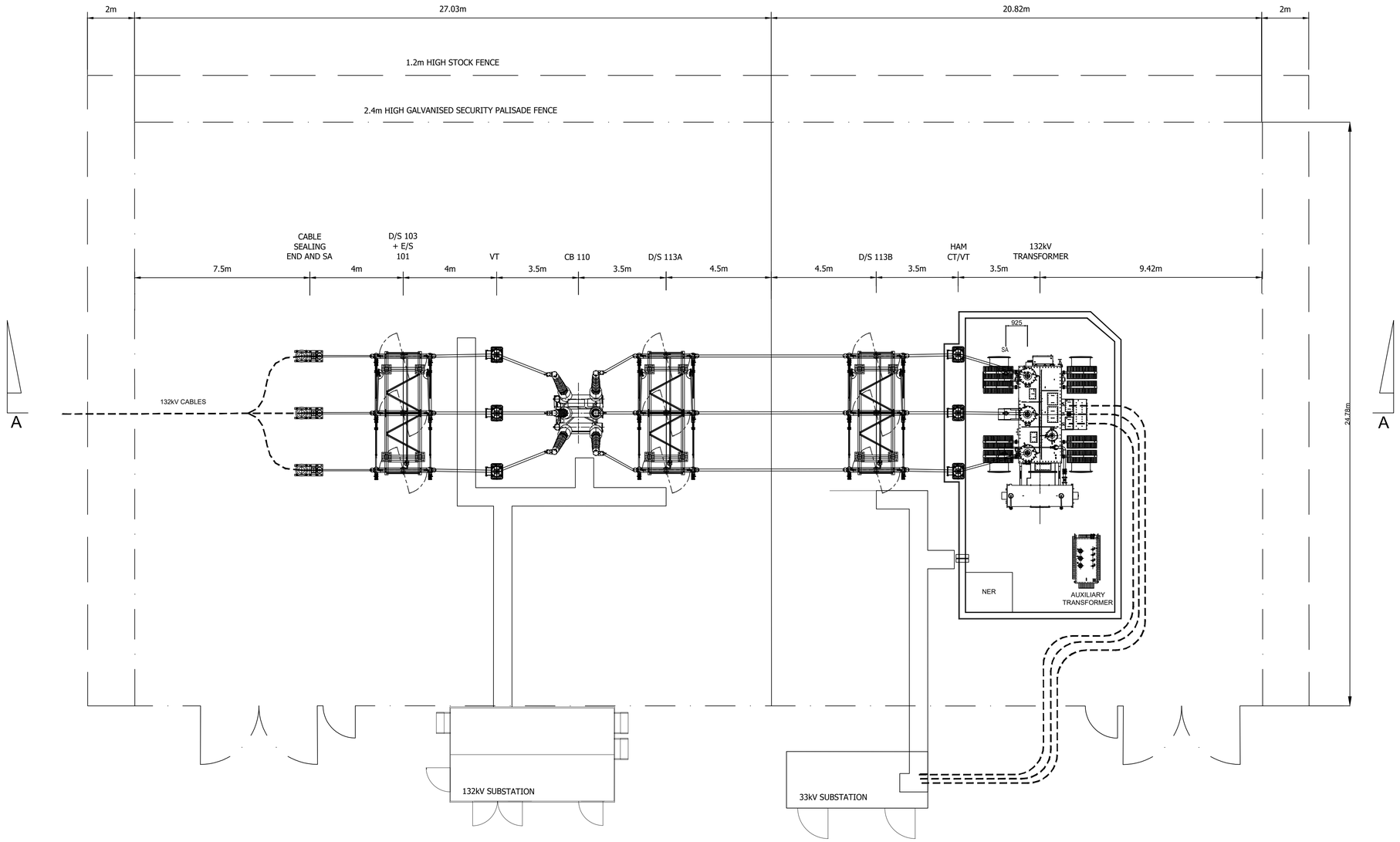
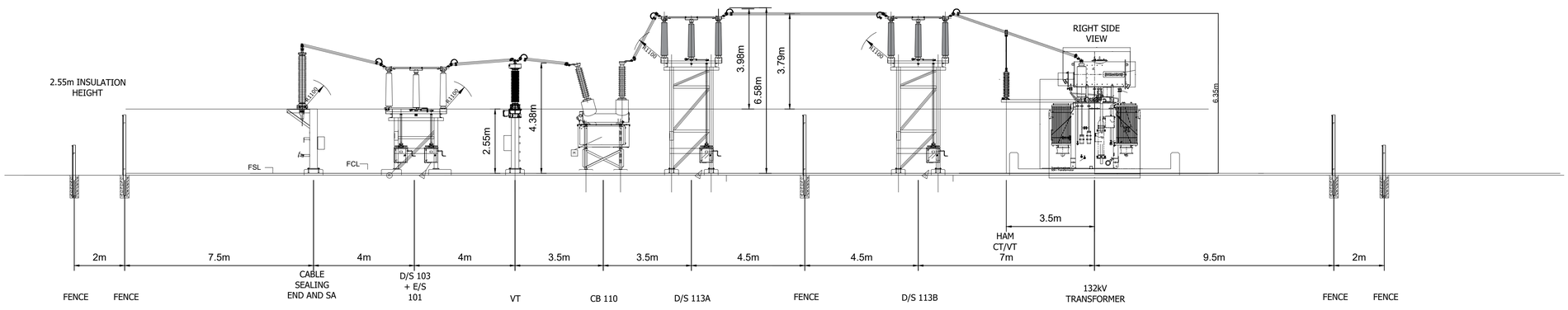
CUSTOMERS COMPOUND





ELEVATION A-A'

NOTES:

Rev.	Date	Description	By	Chk

PROJECT TITLE: BOWSHIEL SOLAR BESS EIAR

CLIENT: voltalia

DRAWING TITLE: FIGURE 3.7 CUSTOMER SUBSTATION DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733784

SCALE @ A1: 1 : 100

APPROVED DATE: 09.05.25

DRAWING NUMBER: DR_P_0016

REVISION: -

Environmental Resources Management

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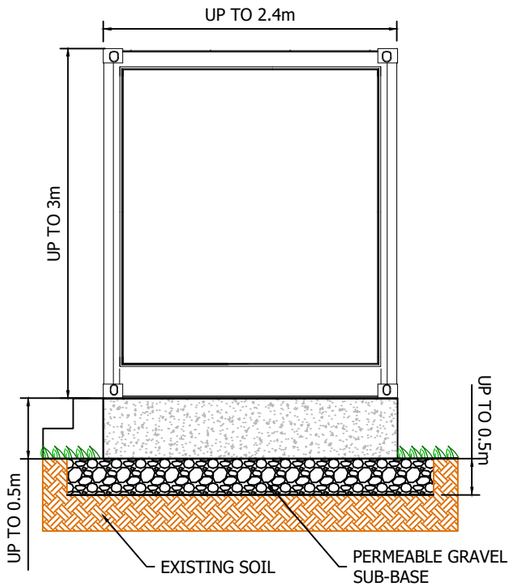

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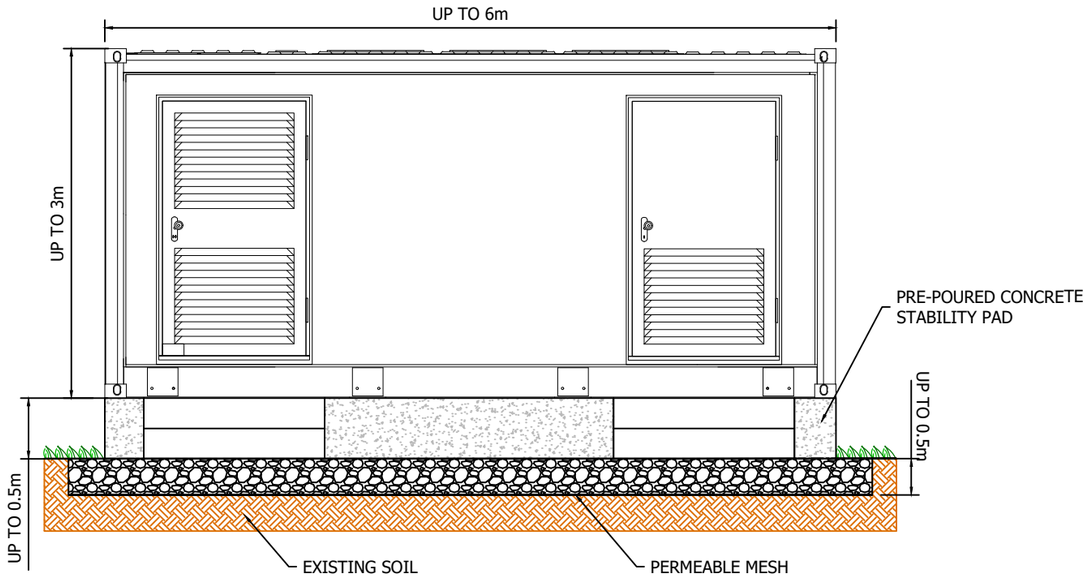

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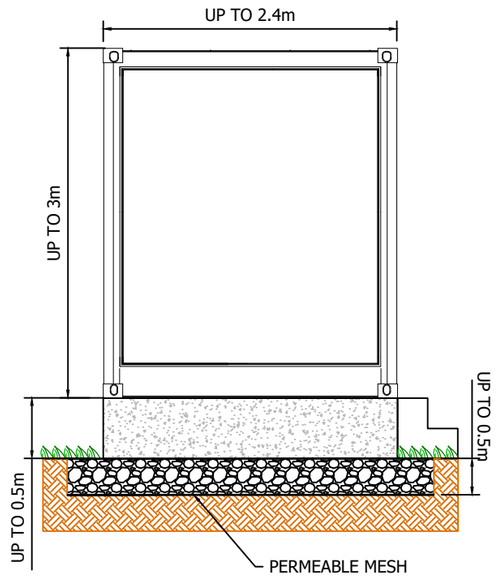
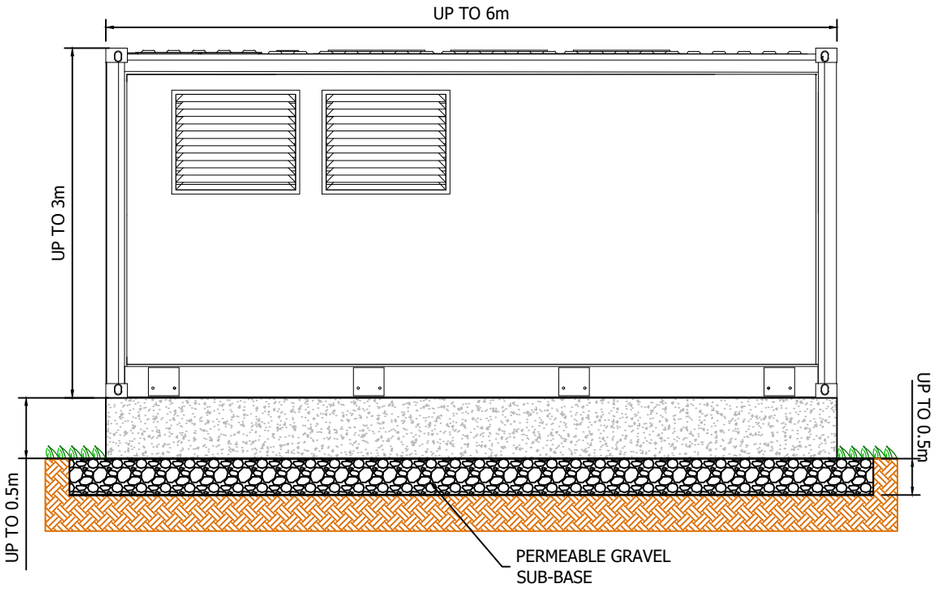


SIDE VIEW



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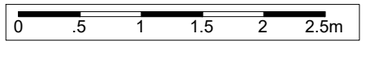

Rev.	Date	Description	By	Chk

PROJECT TITLE:
BOWSHIEL SOLAR
BESS EIAR

CLIENT:
voltalia

DRAWING TITLE:
FIGURE 3.8
33kV CUSTOMER SUBSTATION
DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER:
0733784

SCALE @ A3:	APPROVED DATE:	DRAWING NUMBER:	REVISION:
1 : 50	12.05.25	DR_P_0015	-

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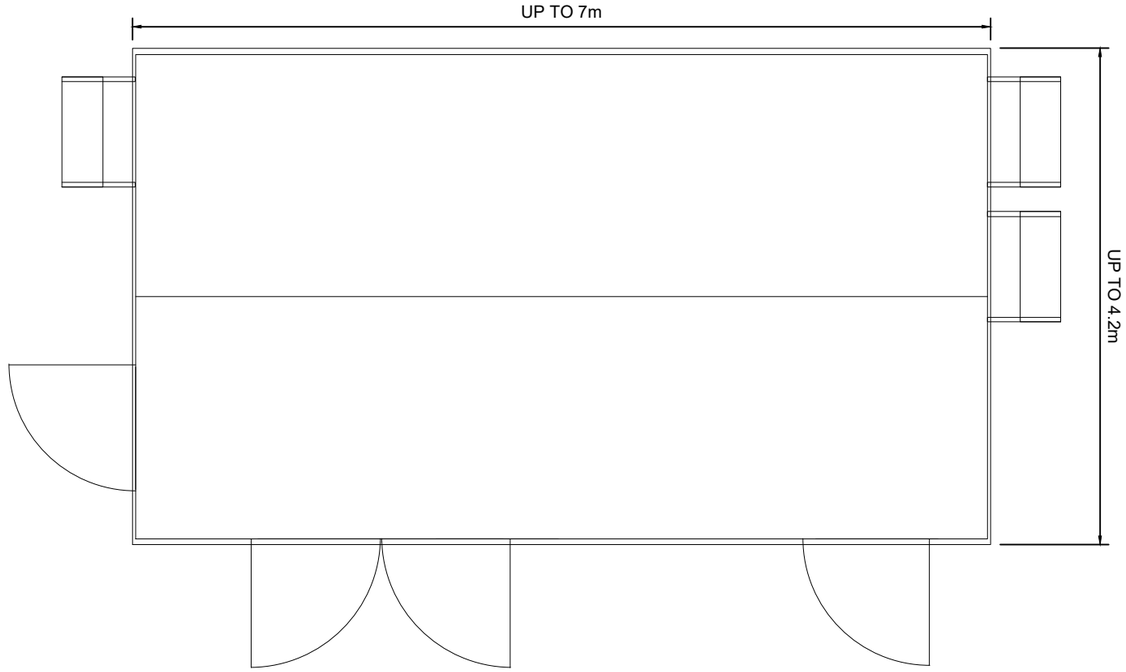
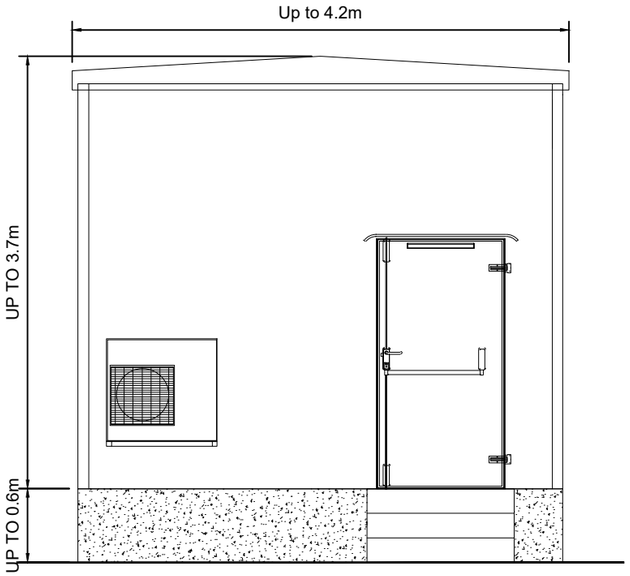
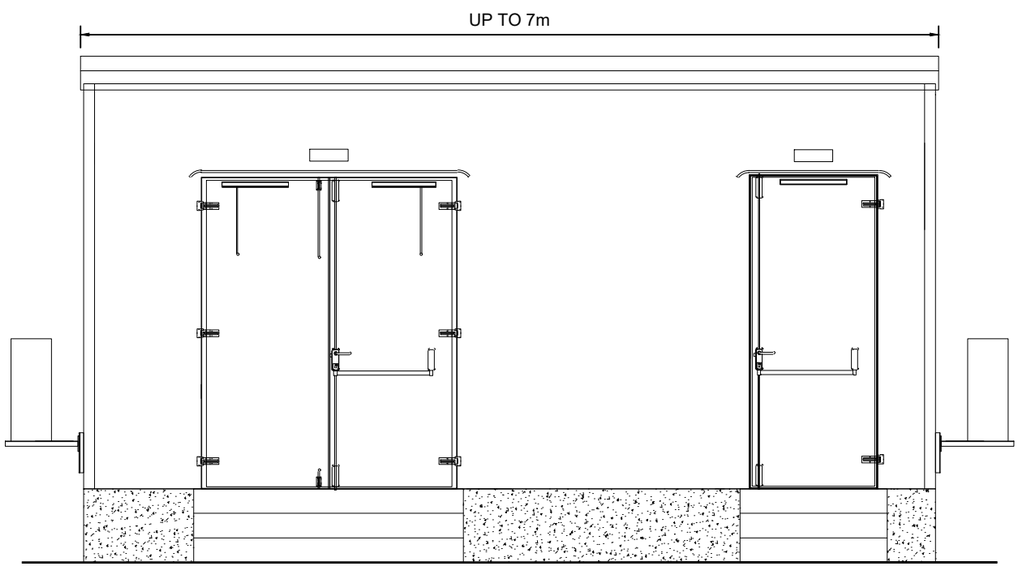


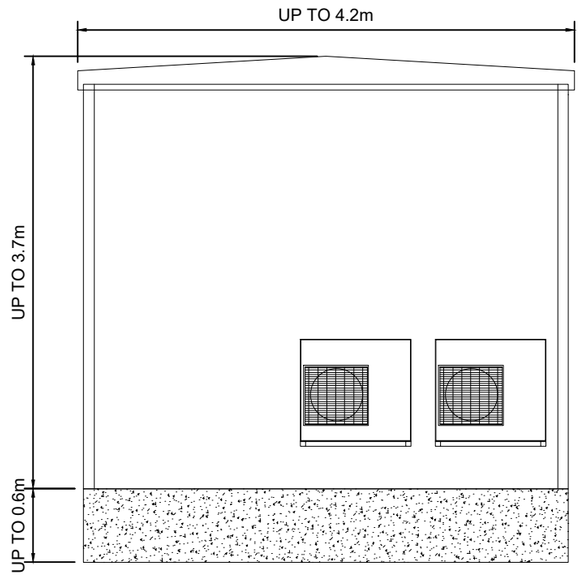
PLAN VIEW



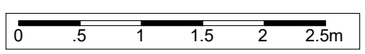
SIDE ELEVATION (LEFT)



FRONT ELEVATION



SIDE ELEVATION (RIGHT)



Rev.	Date	Description	By	Chk

PROJECT TITLE:
BOWSHIEL SOLAR
BESS EIAR

CLIENT:
voltalia

DRAWING TITLE:
FIGURE 3.9
132kV CUSTOMER SUBSTATION
DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733784

SCALE @ A3: 1 : 50

APPROVED DATE: 12.05.25

DRAWING NUMBER: DR_P_0014

REVISION: -

Environmental Resources Management

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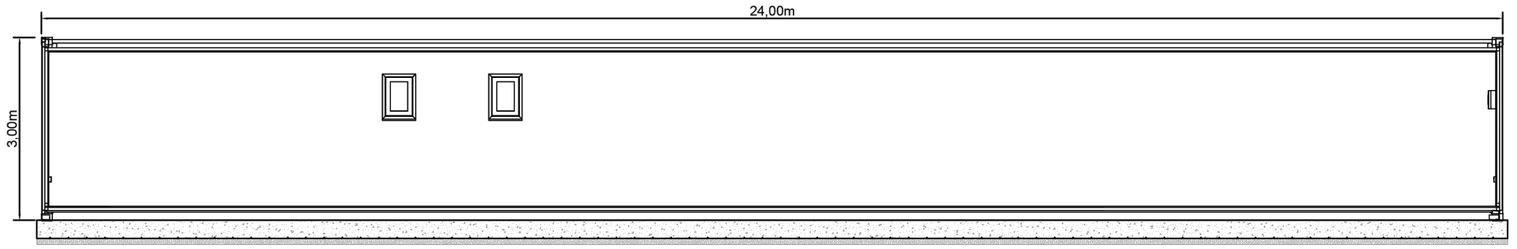
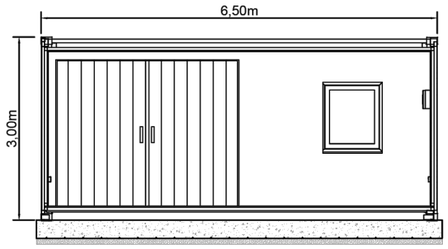
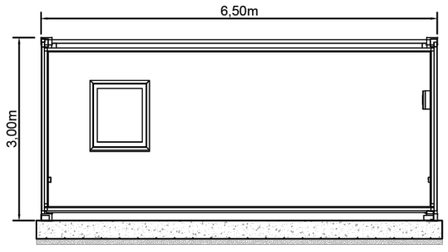


BACK VIEW



RIGHT SIDE VIEW



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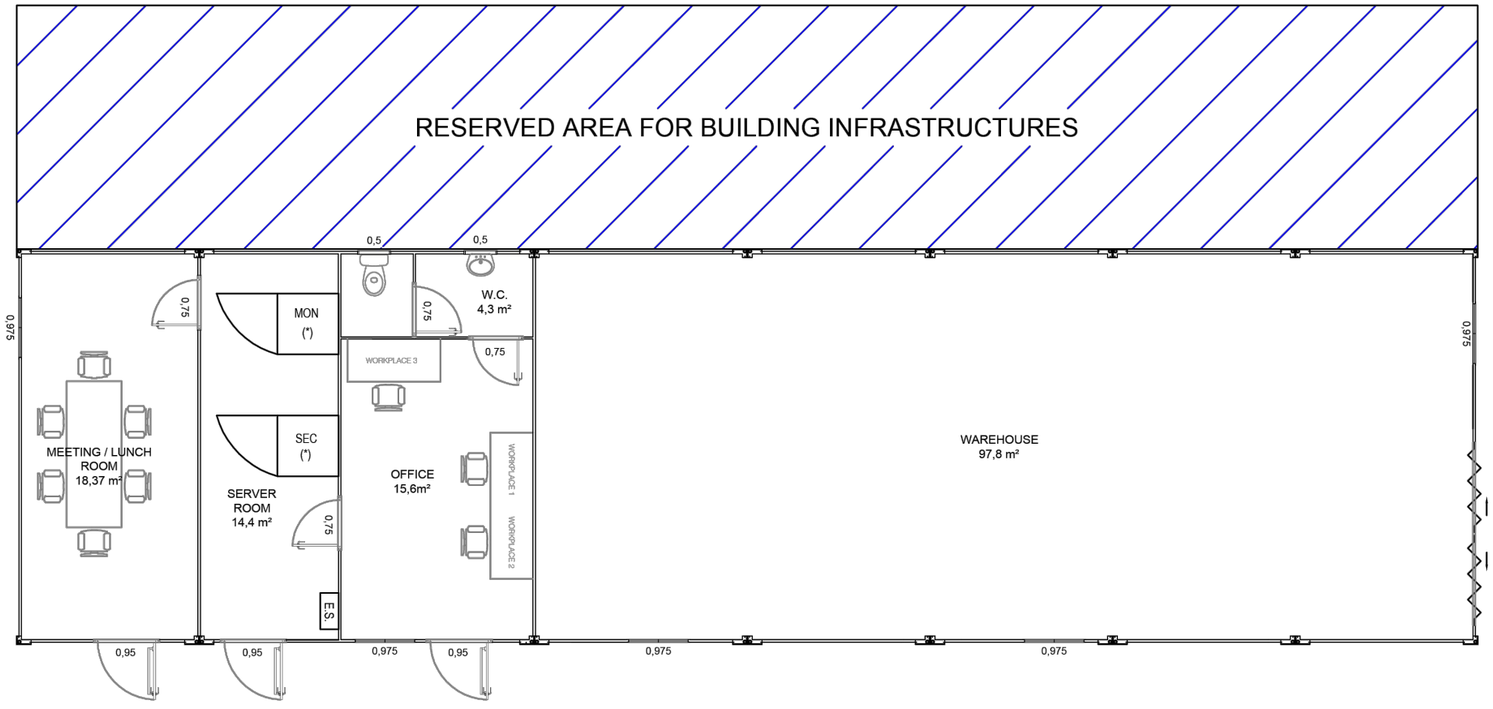
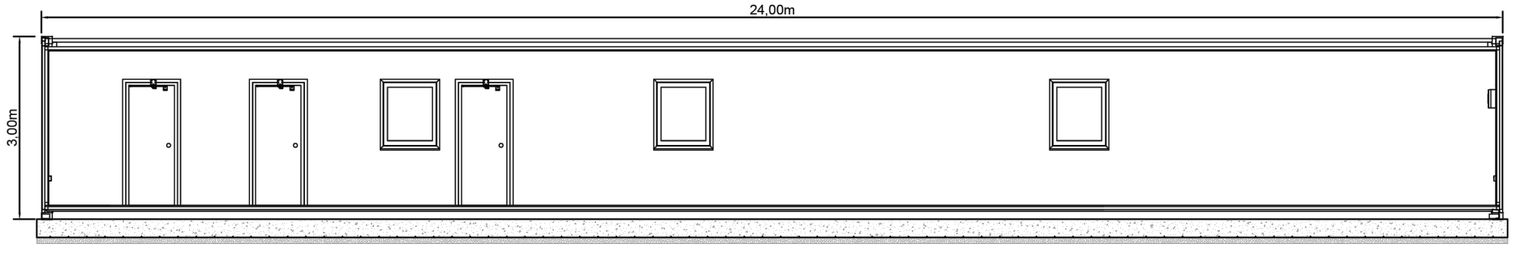


PLANT



FRONT VIEW

0 1 2 3 4 5m

Rev.	Date	Description	By	Chk

PROJECT TITLE: BOWSHIEL SOLAR BESS EIAR

CLIENT: voltalia

DRAWING TITLE: FIGURE 3.10 O&M BUILDING DETAILS

DESIGNED:	DRAWN:	APPROVED:
-	SM	RC

INTERNAL PROJECT NUMBER: 0733784

SCALE @ A3:	APPROVED DATE:	DRAWING NUMBER:	REVISION:
1 : 100	13.03.23	DR_P_0019	-

Environmental Resources Management

ERM

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APPENDIX B– INFODRAINAGE SURFACE WATER DRAINAGE OUTPUTS

Project:	Date: 17/04/2025		
	Designed by: reagan.duff	Checked by:	Approved By:
Report Title: Audit Report	Company Address:		

Rainfall

FEH

Type: FEH

Site Location	GB 375100 671800 NT 75100 71800
Rainfall Version	1999
C (1km)	-0.014
D1 (1km)	0.429
D2 (1km)	0.542
D3 (1km)	0.205
E (1km)	0.242
F (1km)	2.207
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
1.0	0.000
30.0	0.000
200.0	0.000
200.0	39.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

Project:	Date: 17/04/2025		
	Designed by: reagan.duff	Checked by:	Approved By:
Report Details: Audit Report Storm Phase: Phase	Company Address:		

Inflow Summary

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Catchment Area	Cellular Storage		Time of Concentration	0.27	100	0	100	0.27
TOTAL		**0.0**		**0.27**				**0.27**

Outfall Details

Outfalls

Outfall	Outfall Type	Gated	Fixed Surcharged Level (m)	Level Curve
Cellular Storage	Free Discharge			

Flood Warnings

Junctions

No flood warnings are reported

Stormwater Controls

No flood warnings are reported

Discharge Rate

Audit Details

Selected Rainfall
FEH

Results

Outfall	Rainfall	Audit Discharge Rate (L/s)	Actual Discharge Rate (L/s)	Pass/Fail
Cellular Storage	1 (years) + 0 (%)	5.5	1.2	Pass
	30 (years) + 0 (%)	5.5	2.0	Pass
	200 (years) + 0 (%)	5.5	2.7	Pass
	200 (years) + 39 (%)	5.5	3.4	Pass

APPENDIX C – SIMPLE INDEX APPROACH OUTPUTS

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)				
Pollution Hazard Level	Low				
Pollution Hazard Indices					
TSS	0.5				
Metals	0.4				
Hydrocarbons	0.4				
SuDS components proposed					
Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)	SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B			
Component 2	None				
Component 3	None				
SuDS Pollution Mitigation Indices					
TSS	0.7				
Metals	0.6				
Hydrocarbons	0.7				
Groundwater protection type	None				
Groundwater protection Pollution Mitigation Indices					
TSS	0				
Metals	0				
Hydrocarbons	0				
Combined Pollution Mitigation Indices					
TSS	0.7				
Metals	0.6	**Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), Interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but Interception requires separate evaluation.**	Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England		
Hydrocarbons	0.7				
Acceptability of Pollution Mitigation					
TSS	Sufficient				
Metals	Sufficient				
Hydrocarbons	Sufficient				

APPENDIX D– DRAINAGE MAINTENACE PROGRAM

OUTLINE MAINTENACE SCHEDULE FOR AGGREGATE ATTENUATION

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Raking	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers recommendations - pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the stone	As required
	Remedial work to any depressions or rutting considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping / raking	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)

Source: CIRIA (2015). The SuDS Manual. Table 20.15 Operation and Maintenance Requirements for Pervious Pavements.