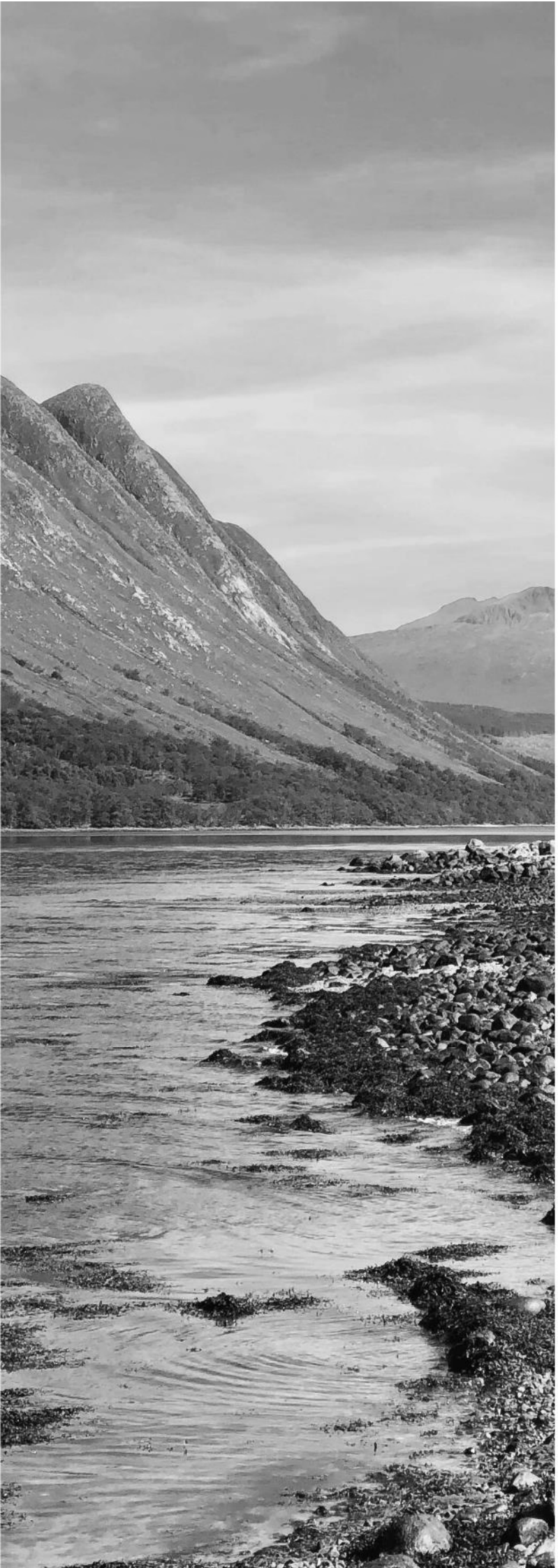

FLOOD RISK AND DRAINAGE ASSESSMENT (FRDA)

KEMPHILL 50MW BATTERY ENERGY STORAGE SYSTEM (BESS)

AE ASSOCIATES

26/04/2022

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Report prepared for	AE Associates Kaimknowe Farm Glendevon FK14 7JZ
Project name	Kemphill 50MW Battery Energy Storage System (BESS)
Project number	P22035
Prepared by	Georgia Sakellariou
Approved by	Derwyn Lear

Revision History

Revision	Date	Prepared By	Reviewed By	Approved By	Comments
0	26/04/2022	Georgia Sakellariou	Derwyn Lear	Derwyn Lear	Issue as draft

Quality Assurance

This report has been prepared according to Gavia Environmental Quality Management Process. Gavia Environmental employs consultant scientists who are members of appropriate professional institutions and adhere to professional codes of conduct.

Disclaimer

This report is presented to AE Associates in respect of this Flood Risk and Drainage Assessment (FRDA), and may not be used or relied on by any other person or by the client in relation to other matters not covered specifically by the scope of this report.

Notwithstanding anything to the contrary contained in the report, Gavia Environmental Ltd is obliged to exercise reasonable skill, care, and diligence in the performance of the services required by AE Associates and shall not be liable except to the extent that it has failed to exercise reasonable skill care and diligence, and this report shall be read and construed accordingly.

The report has been prepared by Gavia Environmental Ltd. No individual is personally liable in connection with the preparation of this report. By receiving this report and acting on it, the client or any other person accepts that no individual is personally liable whether in contract, tort, for breach of statutory duty or otherwise.

Contents

1 Introduction

1.1 Remit

Gavia Environmental Ltd ('Gavia') was commissioned by AE Associates ('The Client') to produce a Flood Risk and Drainage Assessment (FRDA) for a proposed 50MW battery energy storage system (BESS) on a plot of land to the south-west of Coupar Angus, Perth and Kinross.

1.2 Scope of Report

The following tasks have been undertaken within the remit of this report:

- An examination of the current and historical drainage patterns, including the soil classification of the site.
- Review of baseline flood risk, hydrological and hydrogeological conditions.
- An estimation of pre-development and post-development runoff rates and volumes, including attenuation requirements for the critical rainfall event, for the 50MW BESS.
- Drainage modelling using Infodrainage software to determine sizing and placement of SuDS and other drainage infrastructure.

1.3 Proposed Development

The development is located at national grid reference (NGR) NO 20754 39801 to the south-west of Coupar Angus and will include a 50MW BESS and associated infrastructure. Design information to inform this report was provided by email dated 06/04/2022.

2 Policy, Guidance and Standards

2.1 Scottish Planning Policy

Scottish Planning Policy states: *"Development which would have a significant probability of being affected by flooding or would increase the probability of flooding elsewhere should not be permitted."*

The SPP divides flood risk into three categories. The risk framework identifies a low to no risk area where the annual probability of flooding is than 0.1% (1 in 1000 years), a low to medium risk area where the annual probability of flooding is between 0.1% and 0.5% (1 in 1000 to 1 in 200 years), and a medium to high-risk area where the annual probability of flooding is greater than 0.5% (1 in 200 years).

Within medium to high-risk areas in undeveloped and sparsely developed areas, additional development is generally not suitable.

2.2 Perth and Kinross Council

Local authority guidance (Perth and Kinross Council, 2021) requires an FRA to be undertaken for new proposed developments where a review of SEPA flood maps or historical flood data indicates a potential risk of flooding. The guidance requires finished floor levels (FFL) of a development to be a minimum of 600mm above the 200-year flood level including a climate change allowance (herein referred to as 'plus CC'). The guidance states that climate change allowances should be based upon the most recent SEPA published values.

In reference to drainage, Perth and Kinross Council requires a surface water drainage system for new developments which ensures post development runoff rates and volumes do not exceed the pre-development runoff rates and volumes for the critical rainfall events, up to and including the 1 in 200 year plus CC. The drainage system should further be designed to ensure (i) no surcharge during the 1 in 30 year event and (ii) any flooding from the 1 in 200 year event does not encroach within 600mm of property FFLs.

2.3 CAR Regulations

The Water Environment (Controlled Activities) (Scotland) Amended Regulations 2022 (CAR) include a requirement that surface water discharge must not result in pollution of the water environment. It also makes Sustainable Urban Drainage Systems (SuDS) a requirement for new developments, except for runoff from a single dwelling and discharges to coastal waters. The proposed development would be regulated under General Binding Rules (GBR) 10 which specifically requires that the site is 'drained by a SUD system equipped to avoid pollution of the water environment' (SEPA, 2022).

2.4 SEPA Flood Risk Guidance and Flood Maps

The latest version of SEPA 'Technical Flood Risk Guidance for Stakeholders' (SEPA, 2019a) has been consulted during preparation of the FRA. This guidance sets out the minimum requirements and methodologies expected to be adopted for an FRA.

The SEPA flood maps show the likely extent of flooding for high (1 in 10 year), medium (1 in 200 year) and low (1 in 1000 year) likelihood for fluvial, pluvial (surface water) and coastal flooding. It should be noted that SEPA flood maps are indicative, and a detailed assessment of flood risk is required for sites immediately outside or within the SEPA flood extent.

2.5 Climate Change

SEPA guidance on climate change allowances (SEPA, 2022) requires the inclusion of rainfall uplift allowances for surface water flooding and drainage assessments. The proposed development is within the Tay catchment region, and so a 39% increase in peak rainfall intensity must be applied to the 1 in 200-year critical rainfall event.

3 Desk Study

3.1 Site Description

The site consists of vacant land directly south of farm buildings associated with Kemphill, approximately 2km southwest of Coupar Angus, Perth and Kinross. The site covers an area of approximately 0.78Ha. The land is currently used for storage of agricultural plant and materials. Several caravans are present within the site. Site photographs are provided within Appendix A and a site location figure is shown in Appendix B.

3.2 Topography

A topographic survey was undertaken to inform this FRDA (Appendix E). The site forms a shallow basin feature that gently slopes eastwards from 41.5mAOD to 39mAOD.

3.3 Existing Drainage

There is evidence of previous drainage within the site boundary likely associated with foul water septic tanks for static caravans. There is a drainage ditch located directly south of the site and an existing pond east from the site which the ditch enters. Outflows from the pond enter a derelict watermill feature prior to discharging to the River Isla, which is 130m north from the site. No search for utilities have been undertaken within the remit of this report.

3.4 Historical Land Use

Historical mapping (Ordnance Survey 1908, 1970) indicates that the site has not undergone any major alterations throughout the years. The adjacent drainage ditch and pond appear to have been developed to supply the watermill located at Kemphill.

3.5 Ground Conditions

BGS Mapping (BGS, 2022) indicates that the site is underlain by the Cromlix Mudstone Formation, a sedimentary bedrock formation of mudstone and siltstone of the Devonian period. In terms of superficial geology, the site is underlain by glaciofluvial deposits (gravel, sand and silt).

Trial pits that were established on 02/11/2021 and 03/11/2021 and revealed gravelly clay soils with poor infiltration rates (refer to Appendix C).

4 Flood Risk Assessment

Fluvial, surface water, groundwater flooding has been reviewed in the following sections to determine whether the flood hazard is a viable risk to the proposed development and if a further assessment is required. Coastal flooding has been exempted from the assessment due to the site's inland setting.

4.1 Fluvial Flood Risk

According to the SEPA Flood Maps (SEPA, 2022), the site is partly affected by fluvial flooding from the River Isla. A detailed assessment of fluvial flooding has been undertaken for an adjacent and associated solar farm development (Gavia Environmental 2022). This assessment did not identify a risk of flooding at the location of the 50MW BESS site, with adjacent fluvial flood levels during the 1 in 200 year plus 53% allowance for climate change event being approximately 36mAOD. The lowest elevation within the site boundary is approximately 39mAOD. Therefore, the site is considered to be at **little or no risk** of fluvial flooding.

4.2 Surface Water Flood Risk

According to the SEPA Flood Maps (SEPA, 2022), localised pockets of surface water flooding are observed within the site boundary. A bund was observed along the downslope perimeter of the development site which likely restricts runoff leaving the site and may exacerbate localised surface water flooding. The increase in hardstanding associated with the development may increase site runoff rates and hence surface water flood risk downstream.

Mitigation in the form of a new drainage system designed to convey events up to and including the 1 in 200 year plus CC event are proposed. Breakouts should be incorporated into the bund in order that exceedance events can flow away from the site. SuDS proposed for the BESS site will minimise the risk of the development increasing downslope surface water flood risk. Further details on the proposed drainage are provided within Section 5.

Overall, the site is considered to be at **little or no risk** of surface water flooding provided the proposed drainage strategy is implemented.

4.3 Infrastructural Flood Risk

Flooding from existing infrastructure such as reservoirs, drainage systems or flood defences can occur where capacity in the system is insufficient or when maintenance lapses. The site is not nearby or constricted by any upslope infrastructural flooding risk. Any potential flooding from the downslope pond would fall towards the River Isla and away from the site based on the topography. It is noted that there is a large sluice outfall feature that drains the pond to a watermill and which likely has a large capacity. It is therefore considered infrastructural flooding is not a significant hazard and the site is at **little or no risk**.

4.4 Groundwater Flood Risk

According to the SEPA Flood Maps (SEPA 2022), the site is located within an area with a low likelihood that groundwater could influence the duration and extent of flooding from other sources. No significant excavations are assumed to be required and therefore no interaction with groundwater is expected. Percolation tests have indicated poor infiltration rates affecting the site, therefore groundwater conditions may increase the risk of surface water flooding within poorly draining depressions. However, the proposed drainage will likely resolve any potential issues. Overall, the site is considered to be at **little or no risk** from groundwater flooding.

5 Drainage Impact Assessment

5.1 Catchment Area

A catchment area of 0.78Ha has been estimated based on the design information provided. The current design information indicates the development will incorporate areas of semi-pervious hardstanding (compacted aggregate) and impermeable surfaces associated with the battery container units. A percentage impervious (PIMP) value of 80% has been applied given the development proposals.

5.2 Greenfield Runoff Rates

Greenfield runoff rates have been estimated for the 50MW BESS using FEH Rainfall Runoff and ICP SuDS methods within InfoDrainage, and point rainfall descriptors for grid reference NO 20737 39778. Greenfield runoff rates up to and including the 1 in 200 year event plus 39% allowance for climate change (herein referred to as 'CC') are provided within Table 1 below.

Table 1: Greenfield Runoff Rates

Return Period (years)	FEH Rainfall Runoff Peak Flow (l/s)	ICP SuDS Peak Flow (l/s)
1	2.0	2.4
2 (QMED)	**2.4**	2.5
30	4.7	5.2
100	6.0	6.9
200	6.8	7.8
200 + 39% CC	**9.5**	**10.8**

5.3 Post Development Runoff Rates

Peak post development runoff rates for the critical rainfall events from the proposed drainage network, in the absence of SuDS attenuation, have been estimated using the Modified Rational Method within InfoDrainage. These runoff rates are provided within Table 2 below.

Table 2: Post Development Runoff Rates

Return Period (years)	Peak flow (l/s)
2	80.9
30	194.6
100	250.0
200	283.3
200 + 39% CC	**393.4**

5.4 Proposed Discharge Locations

In accordance with CIRIA C753, the hierarchy for disposal of surface water runoff should be (i) infiltration to groundwater, (ii) discharge to surface waters and (iii) discharge to sewer.

Table 3 below provides a review of these options for the proposed development.

Table 3: Surface Water Disposal Options

Surface Water Disposal Method	Review	Method Suitable? (Y/N)
Infiltration to groundwater	Soakaway tests undertaken (Appendix E) did not record a valid Vp value as the observed water level did not sufficiently drain to below the 25% threshold. Therefore, the soils provide insufficient infiltration to enable discharge to groundwater.	N
Discharge to surface waters	A pond was observed to the east and downslope of the site. Drainage modelling has identified that a sufficient fall is achievable to enable an outfall to this feature. Therefore, this is assessed as the preferred option for disposal of surface water.	Y
Discharge to sewers	A search for Scottish Water assets has not been undertaken however it is considered unlikely that a surface water sewer would be present given the rural location.	N

5.5 Proposed SuDS

Given the spatial constraints, it is recommended that a porous engineered fill is adopted below the BESS hardstanding to provide the required attenuation and treatment. The fill would function similarly to permeable paving, storing stormwater within a porous subsurface layer prior to controlled discharge on the downslope side of the feature to the pond outfall. Over areas of uncompacted fill, rainwater would infiltrate naturally into the subsurface layer. Over compacted areas (accesses), porous asphalt or reinforced gravel/grass may be required to ensure infiltration. Underdrains are proposed to effectively drain the subsurface layer and prevent ponding. Outflows would be controlled via a vortex flow control.

The porous engineered fill has been designed in accordance with CIRIA C753 guidance on permeable paving, and dimensions are outlined in Table 4 below. An indicative extent of this feature has been modelled (as shown in Appendix E), however this could be adjusted to suit as the BESS design develops. An assessment of the structural design requirements of the porous fill should also be undertaken at the detailed design stage.

Table 4: Porous engineered fill dimensions

Parameter	Value
Width	64m
Length	81m
Porosity	20%
Depth	0.7m
Storage provided	686m^3

5.6 Drainage Design Criteria

Drainage modelling has been undertaken using InfoDrainage software and a full audit report is provided within Appendix D. The design criteria has been informed by Perth and Kinross

guidance (Perth and Kinross Council 2021). The design criteria is outlined within Table 5 below and the outline design is provided within Appendix E.

Table 5: Drainage design criteria

Parameter	Criteria
Post-development discharge rates	A 2.4l/s restricted discharge rate has been applied to the drainage network which would be achieved via a hydro-brake at the porous fill outlet. This is based on the estimated greenfield QMED for the site (Table 1).
Post-development discharge volumes	The drainage network has been sized to ensure that the post development 1 in 200 year 6 hour rainfall volume does not exceed the pre development equivalent in line with CIRIA C753.
Surcharge criteria	The drainage network has been sized to ensure no surcharge from all events and durations up to and including the 1 in 30 year event
Flood criteria	The drainage network has been sized to minimise flooding from the 1 in 200 year event plus 39% allowance for climate change, however within the constraints of the proposed SuDS and space available for larger SuDS features, a maximum flooded volume of 54m^3 is recorded during the critical 200 year plus CC 48 hour duration event. Further analysis of overland flow pathways is provided within Section 5.7 below.

5.7 Overland Flow Pathways

During the critical 1 in 200 year plus CC rainfall event, a maximum flooded volume of 54m^3 is recorded at the outflow from the porous fill. At the low point of the feature along the eastern boundary of the site, this volume would rise above the surface level and flow directly into the downslope pond. A review of LiDAR data indicates this pond has an indicative volume above mean water level of 2400m^3. The flooded volume of 54m^3 is considered to have only a limited impact on water levels within the pond. The outflow from the pond is via a sluice with a steep and narrow channel through a derelict watermill to the River Isla. No impact on downstream receptors is anticipated from the outflow from the pond (noted peak flows during the 1 in 200 year event within the River Isla are >1000m^3/s).

However, it is proposed that the existing bund on the downslope side of the site is removed or modified as part of the works to ensure any surcharge from the porous fill has an overflow pathway to the pond. This would be necessary to install the new outfall.

5.8 Maintenance and Vesting

Key maintenance requirements as stated within CIRIA C753 for permeable paving will include:

- Brushing and vacuuming (annual).
- Removal of weeds and remediation of any depressions or rutting (as required)
- Rehabilitation of surface and substructure where infiltration is reduced by clogging (as required / every 10 – 15 years).
- Monitor inspection chambers and sediment accumulation rates (annual)

The proposed SuDS and drainage network within the site boundary will be privately owned and maintained, with no requirement for any adoption.

5.9 Alternative Options

An alternative option to consider at the detailed design stage for SuDS may be to formalise the existing pond into a SuDS pond for the development, however there may be difficulties in providing a controlled outflow due to the age of the structure and potential listed status of the watermill.

6 Conclusions

The proposed Kemphill 50MW Battery Energy Storage System (BESS) development has been assessed in relation to major sources of flooding. The development has been assessed as not being at a significant risk of surface water, fluvial, groundwater or infrastructure flooding, provided the proposed drainage strategy is adopted.

An outline drainage design has been developed for the 50MW BESS site incorporating a porous engineered fill beneath the site to provide the necessary treatment and attenuation. All discharges are restricted to 2.4l/s and the drainage network has been sized to ensure no surcharge during the 1 in 30 year event. A flooded volume of 54m^3 is recorded during the critical 1 in 200 year plus 39% allowance for climate change event. Analysis has indicated that this volume would enter an existing pond adjacent to the site and not pose a flood risk to any receptors including the site, provided an existing bund on the downslope perimeter of the site is modified as part of the works.

The drainage impact assessment demonstrates that SuDS are achievable given the development proposals and land available. A detailed drainage design following the principles set out within this report will be submitted to Perth and Kinross Council for approval prior to construction.

Existing drainage infrastructure associated with static caravans within the site may require an intrusive survey and removal prior to construction. No search for utilities has been undertaken within the remit of this report and should be undertaken as part of the detailed design. A geotechnical assessment should also be undertaken as part of the detailed design to inform the structural design and suitability of materials to be adopted within the porous engineered fill.

Overall, this report has demonstrated that there are no overriding impediments to the development being granted planning permission on the grounds of flood risk or surface water drainage.

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Appendix A: Site Photographs

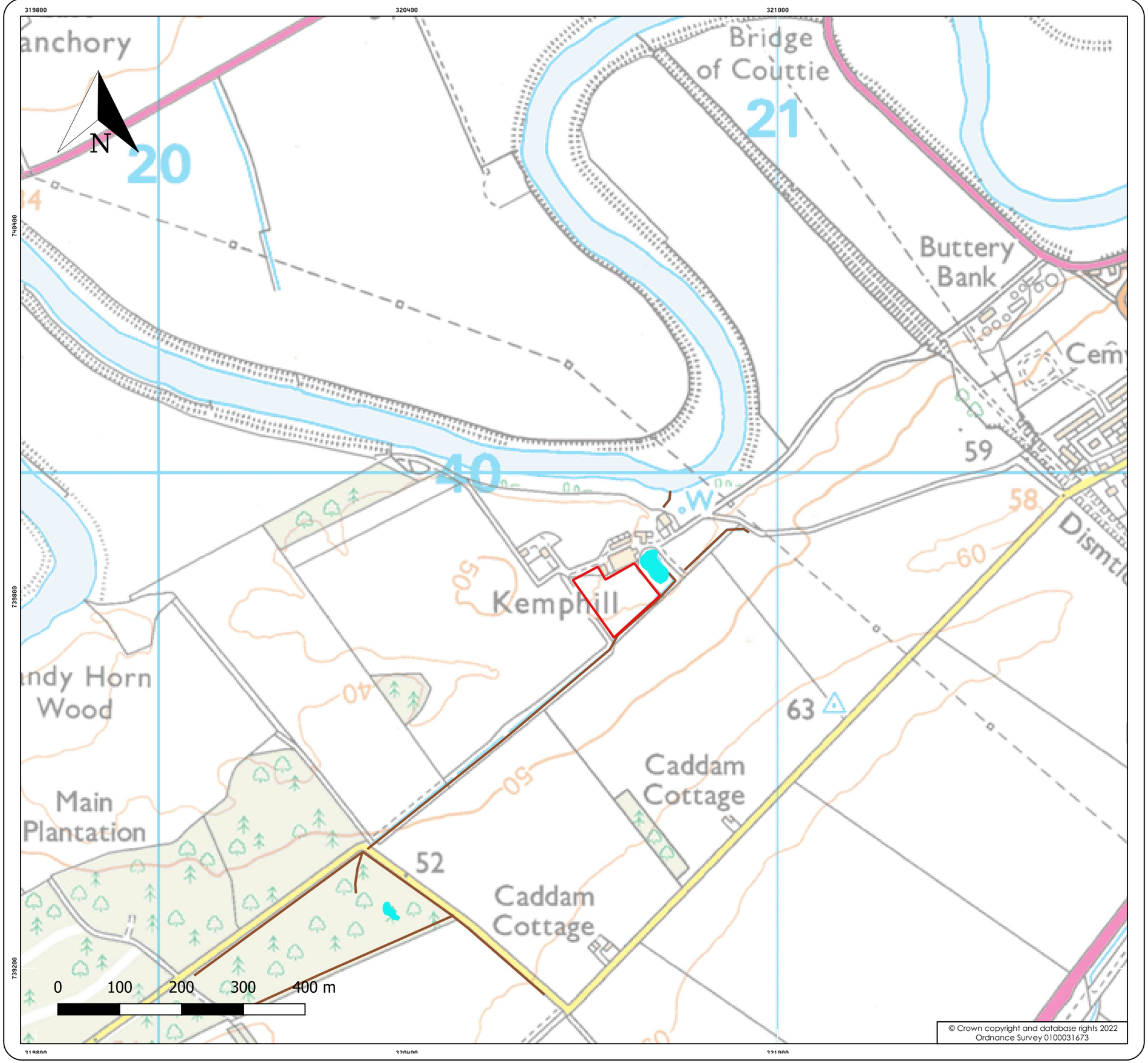
Photograph 1: Looking south from the site entrance

Photograph 1: Looking west within the site, showing the shallow topographic basin

Photograph 3: Existing hardstanding and drainage associated with previous static caravans

Photograph 4: Pond downslope of the site where it is proposed the new drainage will outfall.

Appendix B: Figure



Legend

- 50MW BESS Site Boundary (Indicative)
- Existing Pond
- Drainage Ditches

Project Number: P22053

Project Title: Kemphill 50MW BESS

Client: AE Associates

Figure 1:
Site Overview

Status:	Revision:	Page Size:
DRAFT	1	A3
Drawn:	Reviewed:	Date:
DL	JC	26/04/2022

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Appendix C: Ground Investigations

RESULTS OF SOAKAGE TEST

SKF Ltd
Ground Investigation & Site Surveys

TEST PIT NO. TP01A

Contract Name: KEMPHILL FARM
Contract No.: 6578
Date: 03/11/2021
Weather: DRY & SUNNY SPELLS
Time to fill pit: 2 MINS
Ground Level (mAOD)
Dimensions (m)
Length: 1.00
Width: 0.40
Depth: 1.00

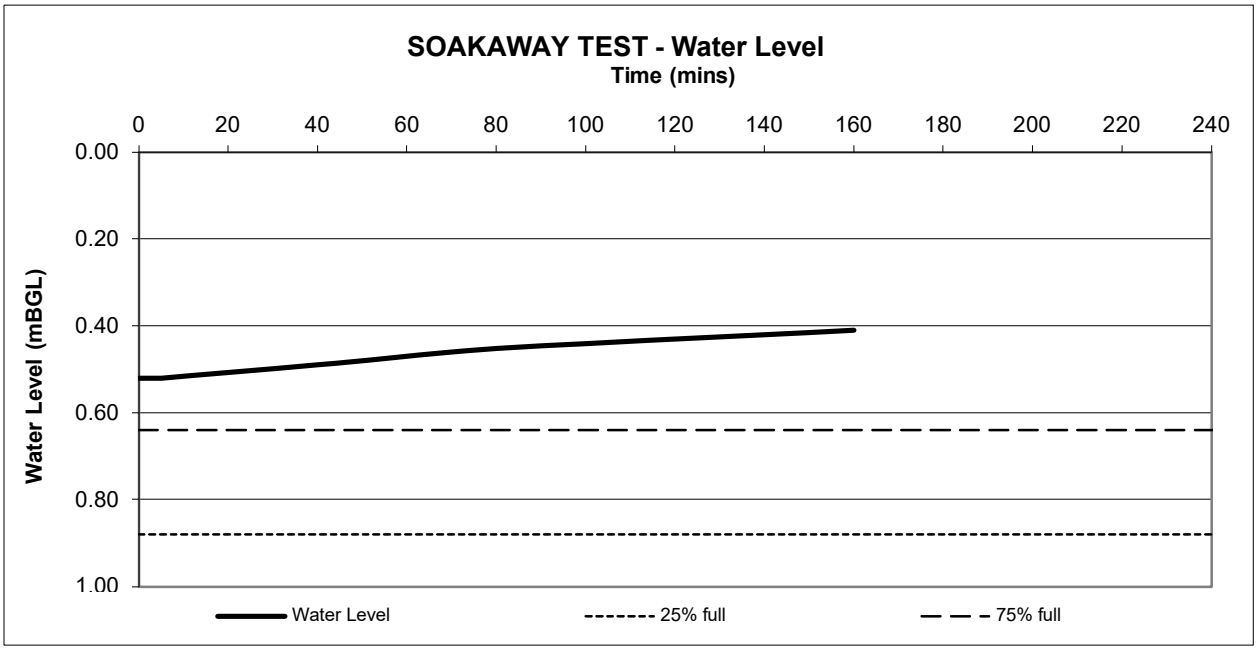
From graph (seconds)
tp75-25 =

Using formula $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$ from BRE Digest 365

f = soil infiltration rate
Vp75-25 = volume of outflow between 75% and 25% eff. depth
ap50 = mean surface area (pit sides to 50% eff. depth + base)
tp75-25 = time for outflow between 75% and 25% eff. depth

Time (mins)	Water Level (mBGL)	Water Level (mAOD)
0.00	0.52	
1.00	0.52	
2.00	0.52	
3.00	0.52	
4.00	0.52	
5.00	0.52	
40.00	0.49	
70.00	0.46	
100.00	0.44	
160.00	0.41	

INFILTRATION RATE (m/s) f = N/A



RESULTS OF SOAKAGE TEST

SKF Ltd
Ground Investigation & Site Surveys

TEST PIT NO. TP02A

Contract Name: KEMPHILL FARM
Contract No.: 6578
Date: 03/11/2021
Weather: DRY & SUNNY SPELLS
Time to fill pit: 2 MINS
Ground Level (mAOD)
Dimensions (m)
Length: 1.00
Width: 0.40
Depth: 1.00

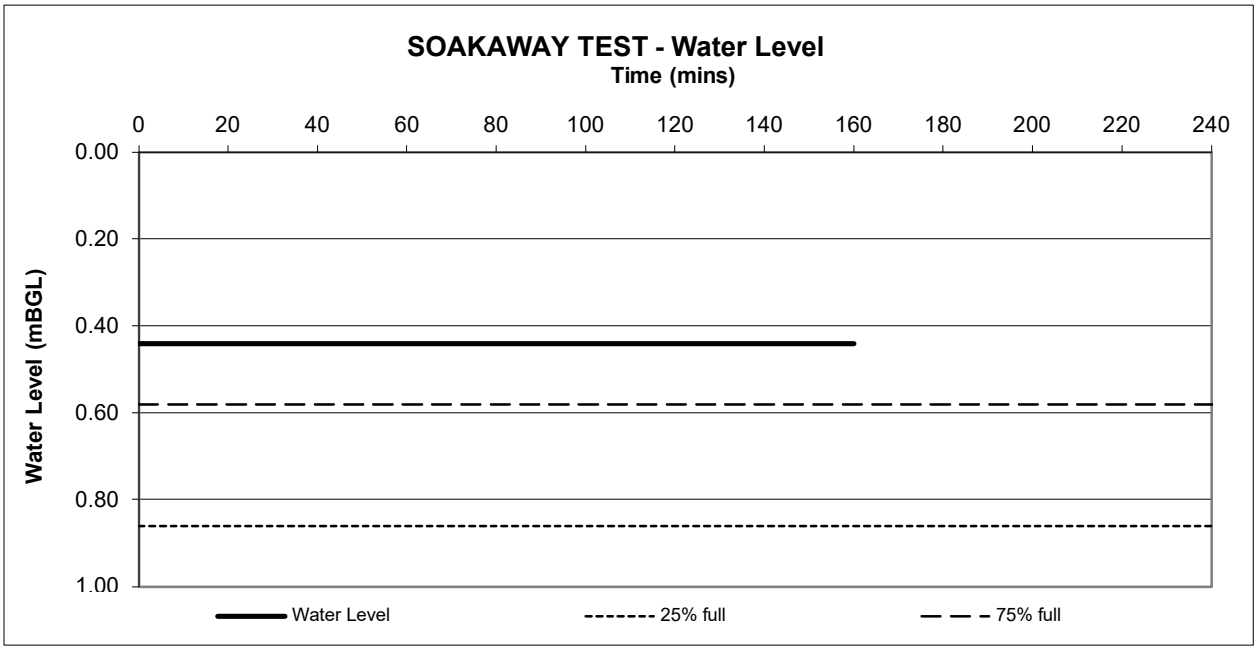
From graph (seconds)
tp75-25 =

Using formula $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$ from BRE Digest 365

f = soil infiltration rate
Vp75-25 = volume of outflow between 75% and 25% eff. depth
ap50 = mean surface area (pit sides to 50% eff. depth + base)
tp75-25 = time for outflow between 75% and 25% eff. depth

Time (mins)	Water Level (mBGL)	Water Level (mAOD)
0.00	0.44	
1.00	0.44	
2.00	0.44	
3.00	0.44	
4.00	0.44	
5.00	0.44	
40.00	0.44	
70.00	0.44	
105.00	0.44	
160.00	0.44	

INFILTRATION RATE (m/s) f = N/A



RESULTS OF SOAKAGE TEST

SKF Ltd
Ground Investigation & Site Surveys

TEST PIT NO. TP03A

Contract Name: KEMPHILL FARM
Contract No.: 6578
Date: 03/11/2021
Weather: DRY & SUNNY SPELLS
Time to fill pit: 2 MINS
Ground Level (mAOD)
Dimensions (m)
Length: 1.00
Width: 0.30
Depth: 1.00

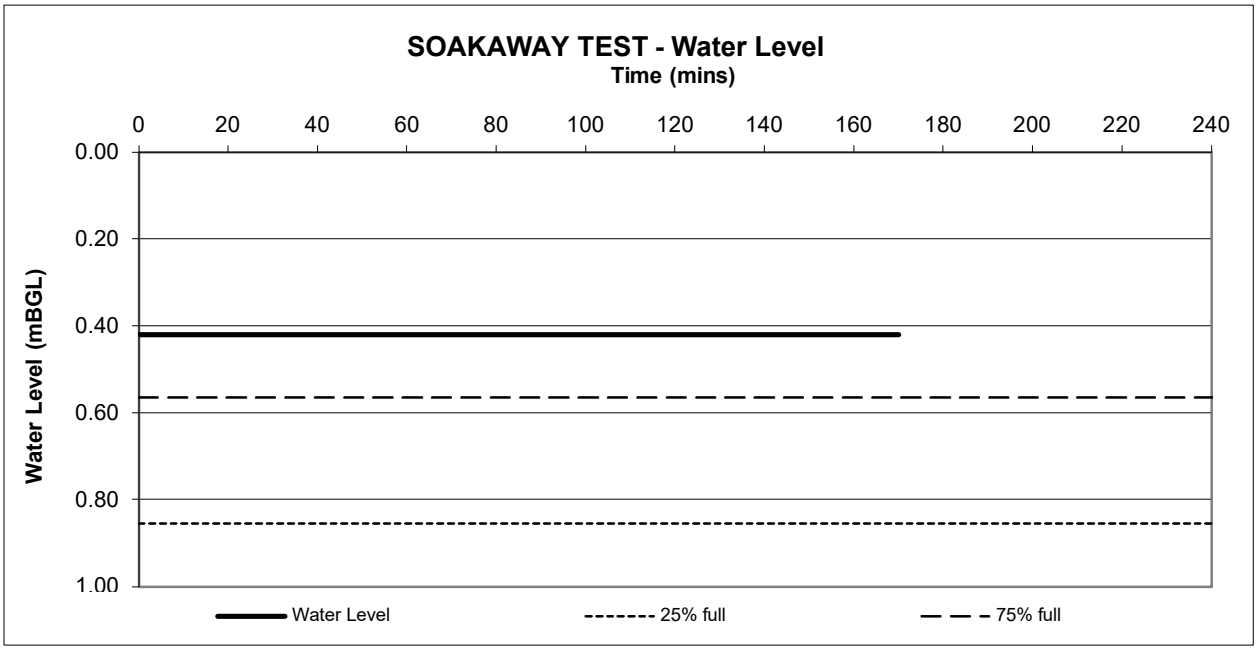
From graph (seconds)
tp75-25 =

Using formula $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$ from BRE Digest 365

f = soil infiltration rate
Vp75-25 = volume of outflow between 75% and 25% eff. depth
ap50 = mean surface area (pit sides to 50% eff. depth + base)
tp75-25 = time for outflow between 75% and 25% eff. depth

Time (mins)	Water Level (mBGL)	Water Level (mAOD)
0.00	0.42	
1.00	0.42	
2.00	0.42	
3.00	0.42	
4.00	0.42	
5.00	0.42	
40.00	0.42	
70.00	0.42	
110.00	0.42	
170.00	0.42	

INFILTRATION RATE (m/s) f = N/A



SKF Ltd
Ground Investigation & Site Surveys

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TRIAL PIT NO. TP01A

Contract: KEMPHILL FARM
Contract No: 6578
Status: FINAL

Client: ARCUS CONSULTING
Pit Dimensions: 1.00 x 0.40
Co-ordinates E

Date: 03/11/2021
Equipment: VOLVO EC27C
N

Description of Strata	Legend	Depth	Level	Sampling	SPT Blows U Blows Hand Vane	Pipe
Ground Surface						
MADE GROUND: Topsoil / turf		0.10				
Loose* dark brown and grey slightly silty slightly clayey gravelly fine to coarse SAND. Gravel fine to coarse and angular to sub rounded.		1.00				

Water Strikes
Strike: Dry Flow:

Details
Casing: Final Depth: 1.00

Stability: Stable
Shoring: None
Backfilling: Backfilled on completion
Notes: Soakaway test carried out at location.

Logged by: AH Checked by: SKF

SYMBOLS KEY

B - BULK
U - UNDISTURBED
D - SMALL DISTURBED
J - JAR
V - VIAL
W - WATER
NR - NO RECOVERY
* - ESTIMATED DENSITY

ALL DIMENSIONS ARE IN METRES

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TRIAL PIT NO. TP02A

Contract: KEMPHILL FARM
Contract No: 6578
Status: FINAL

Client: ARCUS CONSULTING
Pit Dimensions: 1.00 x 0.40
Co-ordinates E

Date: 03/11/2021
Equipment: VOLVO EC27C
N

Description of Strata	Legend	Depth	Level	Sampling	SPT Blows U Blows Hand Vane	Pipe
Ground Surface						
MADE GROUND: Topsoil / turf		0.10				
Loose* light brown slightly silty slightly clayey gravelly fine to coarse SAND. Gravel fine to coarse and angular to sub rounded.		1.00				

Water Strikes
Strike: Dry Flow:

Details
Casing: Final Depth: 1.00

Stability: Stable
Shoring: None
Backfilling: Backfilled on completion
Notes: Soakaway test carried out

Logged by: AH Checked by: SKF

SYMBOLS KEY

B - BULK
U - UNDISTURBED
D - SMALL DISTURBED
J - JAR
V - VIAL
W - WATER
NR - NO RECOVERY
* - ESTIMATED DENSITY

ALL DIMENSIONS ARE IN METRES

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TRIAL PIT NO. TP03A

Contract: KEMPHILL FARM
Contract No: 6578
Status: FINAL

Client: ARCUS CONSULTING
Pit Dimensions: 1.10 x 0.30
Co-ordinates E

Date: 03/11/2021
Equipment: VOLVO EC27C
N

Description of Strata	Legend	Depth	Level	Sampling	SPT Blows U Blows Hand Vane	Pipe
Ground Surface						
MADE GROUND: Topsoil / turf		0.20				
Soft to firm dark brown mottled light brown slightly silty very sandy gravelly CLAY with occasional cobbles. Gravel the to coarse and angular to sub rounded. Clayey gravelly sand often predominates.		1.00				

Water Strikes
Strike: Dry Flow:

Details
Casing: Final Depth: 1.00

Stability: Stable
Shoring: None
Backfilling: Backfilled on completion
Notes: Soakaway test carried out at location.

Logged by: AH Checked by: SKF

SYMBOLS KEY

B - BULK
U - UNDISTURBED
D - SMALL DISTURBED
J - JAR
V - VIAL
W - WATER
NR - NO RECOVERY
* - ESTIMATED DENSITY

ALL DIMENSIONS ARE IN METRES

Appendix D: InfoDrainage Audit

Project:	Date:		
Kemphill 50MW BESS	25/04/2022		
	Designed by:	Checked by:	Approved By:
	J Cousins	D Lear	D Lear
Report Title:	Company:		
Audit Report	Gavia Environmental Ltd		

Rainfall

FEH

Type: FEH

Site Location	GB 320737 739778 NO 20737 39778
Rainfall Version	2013
Data Type	Point
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
30.0	0
200.0	39

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:		
Kemphill 50MW BESS	25/04/2022		
	Designed by:	Checked by:	Approved By:
	J Cousins	D Lear	D Lear
Report Details:	Company:		
Audit Report Storm Phase: Phase	Gavia Environmental Ltd		

Inflow Summary

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
C1	POROUS ENGINEERED FILL		Time of Concentration	0.773	80	0	80	0.619
TOTAL		**0.0**		**0.773**				**0.619**

Pipe Diameter

Audit Details

Range	Min. (mm)
Min. ≤ x	100

Results

All items pass

Surcharge

Audit Details

Range	Max. (m)	Rainfall	Selected Rainfall	Return Period (years)	Increase Rainfall (%)
x ≤ Max.	0.10	Select Rainfall	FEH	30	0

Results

All items pass

Flood Warnings

Junctions

No flood warnings are reported

Stormwater Controls

The following items have failed the audit:

Stormwater Control	Storms	Warning	Flooded Volume (m^3)
POROUS ENGINEERED FILL	200 years: +39 %: 2880 mins: Winter	Flood	53.820

Project:	Date:		
Kemphill 50MW BESS	25/04/2022		
	Designed by:	Checked by:	Approved By:
	J Cousins	D Lear	D Lear
Report Details:	Company:		
Audit Report Storm Phase: Phase	Gavia Environmental Ltd		

Discharge Rate

Audit Details

Selected Rainfall
FEH

Results

Outfall	Rainfall	Audit Discharge Rate (L/s)	Actual Discharge Rate (L/s)	Pass/Fail
OUTFALL TO POND	30 (years) + 0 (%)	2.4	2.2	Pass
	200 (years) + 39 (%)	2.4	2.4	Pass

Discharge Volume

Details

Selected Rainfall	Storm
FEH	200 years: +39 %: 360 mins: Summer

Results

Outfall	Audit Discharge Volume (m^3)	Actual Discharge Volume (m^3)	Pass/Fail
OUTFALL TO POND	330.262	49.595	Pass

Appendix E: Drawings

Appendix as a separate PDF due to file size