FRA and Drainage Strategy Addendum

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Project: Newfields Farm BESS Facility		
Job Number:	00123	**No. of Sheets:**
Subject: FRA and Drainage Strategy Addendum		
Originator: F. Gennard		**Date:** 21.03.2025

Purpose of Calculation:

The following has been submitted as a supplement to the Flood Risk Assessment produced by KRS Environmental (Ref: KRS.0612.002.R.001.G).

The findings of the original Flood Risk Assessment report and the accompanying drainage strategy remain unchanged and should be read in conjunction with this report.

This document has been produced for planning purposes only.

Contents:

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Document Title: Addendum to FRA and Drainage Strategy	**Job Location:**		**Sheet No:**
	Originator: F. Gennard	**Date:** 21.03.2025	
	Revision: B	**Status:** PLANNING	

1.0 Introduction

The following has been submitted as a supplement to the Flood Risk Assessment produced by KRS Environmental (Ref: KRS.0612.002.R.001.G). A copy of which has been included within Appendix A.

The findings of the original Flood Risk Assessment report and the accompanying drainage strategy remain unchanged and should be read in conjunction with this report.

This document has been produced for planning purposes only.

2.0 Site Overview

The Site is situated on land north of Newfields Farm, off Rownall Road, Wetley Rocks, Stoke on Trent, Staffordshire, ST9 9LA. The Site is centred on approximate National Grid Reference 394387, 349120.

A site location plan is shown in Figure 1.

Figure 1: Site Location Plan

Source: Extract from P23-O415_EN_0001_C_1 SL

The site is currently agricultural land and is bounded by the Cellarhead National Grid Substation to the north, an existing drainage ditch and open fields to the west, an access road and open fields to the east and Newfield Farm to the south.

A topography survey was undertaken and found the site generally falls from southeast to northwest.

The Proposed Development is for a battery energy storage facility and associated infrastructure (see Appendix C). Further details with regard to the Proposed Development can be found in the accompanying information submitted within the planning application.

3.0 Key findings of the Flood Risk Assessment

The Flood Risk Assessment produced by KRS Environmental assessed the site for the following sources of flooding:

- Fluvial Flooding
- Tidal Flooding
- Groundwater Flooding
- Surface Water Flooding
- Sewer Flooding
- Flooding from Artificial Drainage Systems/ Infrastructure Failure

It found that the site was in Flood Zone 1 with the only other source of flooding being from surface water.

4.0 Reason for Addendum

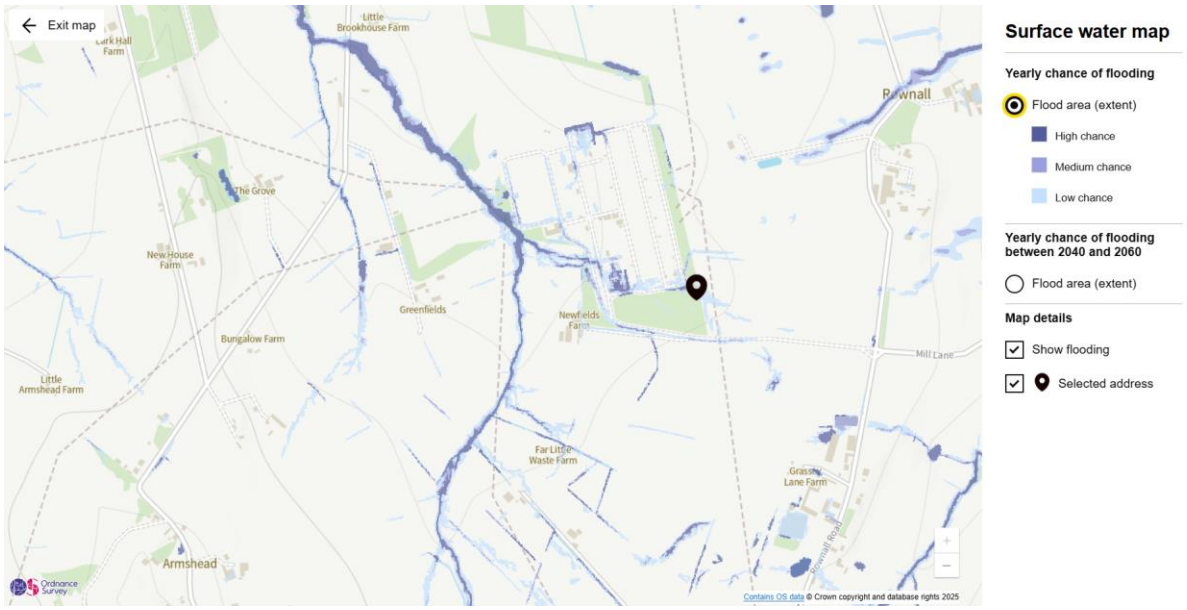
While the site sits in Flood Zone 1, due to the presence of a surface water flood risk, it was felt that an additional assessment should be provided. This is to ensure that the site had been set out with surface water flood risk in mind and that there is no increase in flood risk pre or post development.

5.0 Overview of Surface Water Flood Risk

With reference to the EA's online mapping, data related to the risk of potential surface water inundation or flooding is shown in Figure 2.

From looking at the map, there is a medium to high risk of surface water flooding which crosses the northern part of the site from east to west, before connecting into the existing drain which runs down the western boundary.

Figure 2: Surface Water Flood Maps



Source: https://check-long-term-flood-risk.service.gov.uk/map?easting=394720&northing=349077&map=SurfaceWater

This was confirmed by the LLFA who provided the following response as part of their assessment on the original Planning Application.

"Yes, the updated Flood Map for Surface Water(uFMfSW) does affect the proposed site area. The northern portion of the site is affected by surface water flooding during the 1 in 30-year event. Small areas of localised flooding are shown along the length of the unnamed watercourse flowing adjacent to the site's western boundary. In addition, there is localised surface water flooding shown in the vicinity of an existing land drain which heads towards the sites north-western boundary.

During the 100-year rainfall period, there is the start of a route for surface water to flow through the northern end of the development site.

Surface water is shown to pool on the access road to the east of the site before heading west through the development site toward the unnamed watercourse along the site western site boundary.

This flow path becomes more evident during the 1000-year rainfall event with the extent of surface water flooding also affecting a greater area within the northern areas of the development site."

The flood maps were overlain onto the proposed layout (see Appendix D) and showed that surface water collected on the accessway before heading northwest across the site towards the drainage ditch.

The key areas affected are the 132/33 kV switchyard, DNO control building, customer switch room, customer store building, auxiliary transformer.

6.0 Analysis of design proposals

While the site sits in Flood Zone 1, due to the presence of a surface water flood risk, it was felt that an additional assessment should be provided. This is to ensure that the site had been set out with the surface water flood risk in mind and that there is no increase in flood risk pre or post development.

6.1 Overview

The site is currently classed as being wholly in Flood Zone 1, however, from looking at the surface water flood maps, surface water is shown to pool on the access road to the east of the site before heading west through the development site toward the unnamed watercourse along the western site boundary.

This flow path becomes more evident during the 1000-year rainfall event with the extent of surface water flooding also affecting a greater area within the northern areas of the development site.

As such, the site will need to be set out with this risk in mind to ensure that there is no increase in flood risk pre or post development.

6.2 Analysis

The development is for a battery energy storage facility and associated infrastructure (see Appendix C). Further details regarding the Proposed Development can be found in the accompanying information submitted as part of the planning application.

From overlying the surface water flood maps (see Appendix D), surface water appears to collect on the accessway before heading northwest across the site towards the drainage ditch. The key areas affected are the 132/33 kV switchyard, DNO control building, customer switch room, customer store building, auxiliary transformer.

The KRS report highlighted that the maximum depth of water would be 300mm.

This was confirmed by a SCARLO analysis which predicted that the depth of water according to the Environment Agency Flood Mapping would range from 150mm to 300mm.

From looking at a more detailed SCARLO analysis, which takes closer contours it can be seen that the surface water flood risk is reduced as the area slopes quite steeply from southeast to northwest with no obvious plateaus or low spots where water could naturally collect (see Figure 3).

In addition, it is currently proposed that any equipment will sit on concrete pads which are raised at least 300mm above ground level (as per industry standard, see Appendix E) which would raise equipment above the maximum depth of water.

As such it is believed that the proposed equipment would be above any anticipated flood event.

Finally, while an acoustic bund is proposed, this has been designed so that the existing flow paths would be maintained as part of the development and as such would not have a detrimental impact on the depth, location or extent of flooding.

Figure 3: Extract from SCARLO Assessment

Source: SCARLO Analysis

In summary, the proposal will bring much needed energy storage infrastructure to the region which will help balance the electrical grid by storing energy when it's abundant and releasing it when demand is high.

These Battery Energy Storage Systems are important for integrating renewable energy sources like wind and solar into the grid.

While it is noted that the Environment Agency does highlight a surface water flood risk through the site, it is believed that this is more in relation to overland flow as opposed localised low spots and ponding. As such, as the existing flow paths will be maintained as part of the development, and, critical equipment will be positioned on plinths which are at a higher level than the maximum anticipated flood depth, it is therefore considered that the development has been positioned in the most suitable location and the risk of surface water flooding will not be increased as part of this development.

Appendix A – KRS Flood Risk Assessment

Newfields Farm, Wetley Rocks, Stoke on Trent, ST9 9LA

Flood Risk & Surface Water Drainage Assessment

For Newfields BESS Ltd

KRS.0612.002.R.001.G

January 2024

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Newfields Farm, Wetley Rocks, Stoke on Trent

Project	Flood Risk & Surface Water Drainage Assessment
Client	Newfields BESS Ltd
Status	Final
Prepared by	Emma Serjeant LL.B, MSc
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Date	January 2024

CONTENTS

TABLES & FIGURES

EXECUTIVE SUMMARY

The Site would be expected to remain dry in all but the most extreme conditions. The consequences of flooding are acceptable, and the development would be in accordance with the requirements of the National Planning Policy Framework (NPPF). The Proposed Development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF. The Proposed Development will considerably reduce the flood risk posed to the Site and to off-site locations due to the adoption of a Sustainable Drainage Systems (SuDS) Strategy.

The Proposed Development should not therefore be precluded on the grounds of flood risk or drainage.

1.0 INTRODUCTION

1.1 Background

This Flood Risk and Surface Water Drainage Assessment (FRA) has been prepared by KRS Environmental Limited at the request of Newfields BESS Ltd to support a planning application for the development of a battery storage facility ("the Proposed Development") on land north of Newfields Farm, off Rownall Road, Wetley Rocks, Stoke on Trent, Staffordshire, ST9 9LA ("the Site").

This FRA has been carried out in accordance with guidance contained in the National Planning Policy Framework (NPPF)[1] and associated Planning Practice Guidance (PPG)[2]. This FRA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

It is recognised that developments which are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works.

1.2 National Planning Policy Framework

One of the key aims of the NPPF is to ensure that flood risk is taken into account at all stages of the planning process; to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk.

It advises that where new development is exceptionally necessary in areas of higher risk, this should be safe, without increasing flood risk elsewhere, and where possible, reduce flood risk overall. A risk-based approach is adopted at stages of the planning process, applying a source pathway receptor model to planning and flood risk. To demonstrate this, an FRA is required and should include:

- whether a proposed development is likely to be affected by current or future flooding from all sources;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- if necessary, provide the evidence to the Local Planning Authority (LPA) that the Sequential Test can be applied; and
- whether the development will be safe and pass part c) of the Exception Test if this is appropriate.

1.3 Report Structure

This FRA has the following report structure:

- Section 2 details the sources of information that have been consulted;
- Section 3 describes the location and the existing and proposed development;

[1] Ministry of Housing, Communities and Local Government (2023) National Planning Policy Framework.
[2] Communities and Local Government (2022) Planning Practice Guidance - Flood Risk and Coastal Change.

- Section 4 outlines the flood risk to the existing and proposed development;
- Section 5 details the proposed surface water drainage for the site and assesses the potential impacts of the proposed development on surface water drainage;
- Section 6 details the sequential and exception tests; and
- Section 7 presents conclusions.

2.0 SOURCES OF INFORMATION

2.1 Discussion with Regulators

Consultation and discussions with the relevant regulators have been undertaken during this FRA including the Environment Agency, the Local Planning Authority (LPA), the Lead Local Flood Authority (LLFA) and Sewerage Undertakers.

2.1.1 Environment Agency

The Flood and Water Management Act 2010 gives the Environment Agency a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for the prevention, mitigation and remediation of flood damage for main rivers and coastal areas. The Environment Agency is the statutory consultee with regards to flood risk and planning.

Environment Agency Flood Risk Standing Advice for England, the NPPF and PPG have been consulted and reviewed during this FRA. This has confirmed the level of FRA required and that a surface water drainage assessment is to be undertaken. Information regarding the current flood risk at the Site and local flood defences has been obtained from the Environment Agency.

2.1.2 Staffordshire Moorlands District Council

Staffordshire Moorlands District Council is the LPA. Planning guidance written by Staffordshire Moorlands District Council regarding flood risk was consulted to assess the mitigation policies in place. The Staffordshire County Council Preliminary Flood Risk Assessment (PFRA) which covers the Site has been reviewed.

2.1.3 Staffordshire County Council

Staffordshire County Council as the LLFA is a statutory consultee for major planning applications in relation to surface water drainage, requiring that all planning applications are accompanied by a SuDS Strategy. The aim of the SuDS Strategy is to identify water management measures, including SuDS, to provide surface water runoff reduction and treatment. Whilst the Proposed Development would not constitute a 'major development' due to its scale, a SuDS approach has been adopted.

2.1.4 Severn Trent Water

Severn Trent Water is responsible for the disposal of wastewater and supply of clean water for this area. Information with regards to sewer and water main flooding contained within Staffordshire Moorlands District Council SFRA and the Staffordshire County Council Preliminary Flood Risk Assessment (PFRA) have been consulted. All Water Companies have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register.

3.0 LOCATION & DEVELOPMENT DESCRIPTION

3.1 Site Location

The Site is situated on land north of Newfields Farm, off Rownall Road, Wetley Rocks, Stoke on Trent, Staffordshire, ST9 9LA. The Site is centred on approximate National Grid Reference 394387, 349120. The location of the Site is shown in Figures 1 and 2.

Figure 1 - Site Location

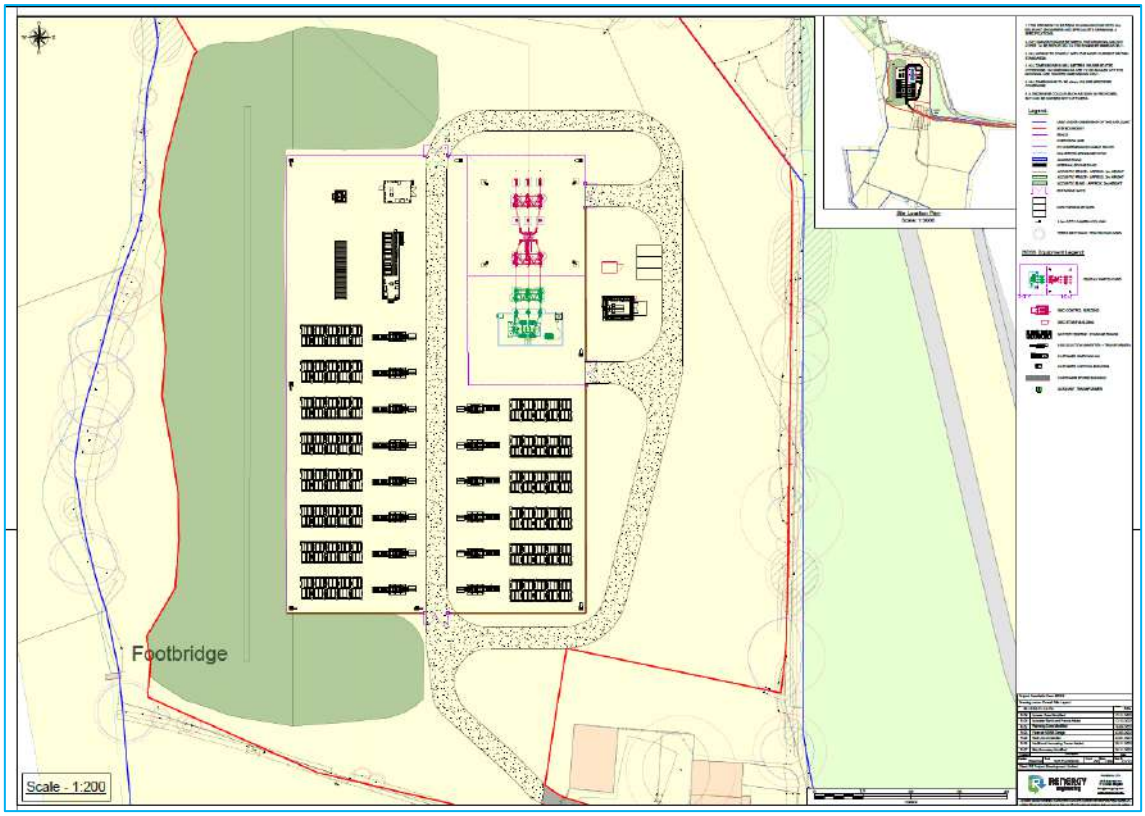


Figure 2 - Statutory Plan

3.2 Existing Development

The Site is currently agricultural land adjacent to an existing electricity substation.

3.3 Proposed Development

The Proposed Development is for a battery storage facility and associated infrastructure (see Appendix 1). Further details with regard to the Proposed Development can be found in the accompanying information submitted with the planning application.

3.4 Catchment Hydrology / Drainage

A drainage ditch is located adjacent to the western boundary of the Site which ultimately discharges into Stanley Pool. The Site currently comprises permeable land with no formal drainage system.

3.5 Ground Levels

The Site is relatively flat with an approximate ground level of 230 metres Above Ordnance Datum (mAOD).

3.6 Ground Conditions

The British Geological Survey (BGS) map shows that the superficial deposits consist of Till, Devensian - diamicton. The bedrock deposits consist of the Morridge formation group - mudstone, siltstone and sandstone. Sedimentary bedrock formed approximately 320 to 329 million years ago in the Carboniferous Period.

Information from the National Soil Resources Institute details the Site area as being situated on slowly permeable, seasonally wet acid loamy and clayey soils with impeded drainage. The Wallingford

Winter Rain Acceptance Potential (WRAP) map indicates that the site lies within WRAP Class 4: clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

A Ground Investigation Report has been prepared by Greencat Geotechnical in August 2023. The Groundsure Report referred to within the Ground Investigation Report indicates that the permeability of the natural superficial soils beneath the site is likely to vary between low and high, most likely depending on the fraction of clay and/or silt within the soils. An estimate of the permeability of the made ground shown to lie on the north-east of the site is not given in the report but is likely to be similar to the natural soils. Therefore, the permeability of the bedrock at the site is indicated to vary between low and high, with water flow most likely along fractures and other discontinuities within the rock mass

4.0 FLOOD RISK

4.1 Sources of Flooding

All sources of flooding have been considered, these are; fluvial (river) flooding, tidal (coastal) flooding, groundwater flooding, surface water (pluvial) flooding, sewer flooding and flooding from artificial drainage systems/infrastructure failure.

4.2 Environment Agency Flood Zones

A review of the Environment Agency's Flood Zones indicates that the Site is located within Flood Zone 1 and therefore has a 'low probability' of flooding as shown in Figure 3, with less than a 1 in 1000 annual probability of river in any year (<0.1%).

The Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development. They show the worst-case scenario.

The Environment Agency Flood Zones and acceptable development types are explained in Table 1. Table 1 shows that all development types are generally acceptable in Flood Zone 1.

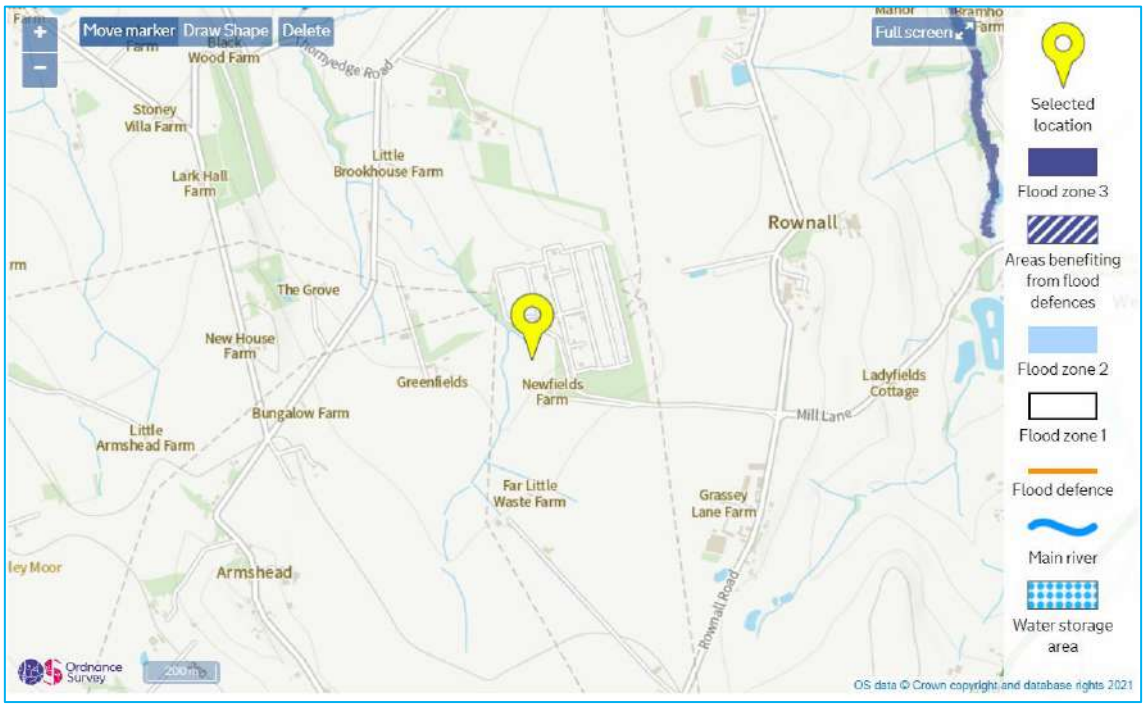


Figure 3 - Environment Agency Flood Zones

Table 1 - Environment Agency Flood Zones and Appropriate Land Use

Flood Zone	Probability	Explanation	Appropriate Land Use
Zone 1	Low	Less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)	All development types generally acceptable
Zone 2	Medium	Between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% 0.1%) in any year	Most development type are generally acceptable
Zone 3a	High	A 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year	Some development types not acceptable
Zone 3b	'Functional Floodplain'	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: • land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)	Some development types not acceptable

4.3 Flood Vulnerability

In the Planning Practice Guidance to the NPPF, appropriate uses have been identified for the Flood Zones. Applying the Flood Risk Vulnerability Classification in the PPG, the proposed use is classified as 'essential infrastructure'. Table 2 of this report and the PPG states that 'essential infrastructure' uses are appropriate within Flood Zone 1 after the completion of a satisfactory FRA.

Table 2 - Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception test required	✓	✓
Zone 3a	Exception test required	✓	×	Exception test required	✓
Zone 3b 'Functional Floodplain'	Exception test required	✓	×	×	×

Key: *✓: Development is appropriate, ×: Development should not be permitted.*

4.4 Historic Flooding

Environment Agency data shows that the Site has not historically flooded. There are no records of anecdotal information of flooding at the Site including within the British Hydrological Society "Chronology of British Hydrological Events[4]". No other historical records of flooding for the Site have been recorded. Therefore, it has been concluded that the Site has not flooded within the recent past.

4.5 Existing and Planned Flood Defence Measures

Environment Agency data confirms that the Site is not protected against flooding by existing flood defence measures (see Figure 3).

4.6 Climate Change

Projections of future climate change, in the UK, indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Guidance included within the NPPF recommends that the effects of climate change are incorporated into FRA's. Recommended precautionary sensitivity ranges for peak rainfall intensities and peak river flows are outlined in the flood risk assessments: climate change allowances guidance[3]. Table 3 shows peak river flow allowances by river basin district.

As per Environment Agency guidance, the anticipated lifetime of the development is deemed to be 75 years however, the actual lifetime of the development will be less. The flood risk assessments: climate change allowances guidance recommends that for 'essential infrastructure' uses in Flood Zone 1 that the central allowances are used. Therefore, the design flood level for the Site is the 1 in 100 year (+31%) event.

Table 3 - Peak River Flow Allowances

River basin district	Allowance category	2020s	2050s	2080s
Dove Management Catchment	Upper	+28%	+39%	+62%
	Higher	+17%	+24%	+40%
	Central	+13%	+18%	+31%

[3] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#high-allowances

4.7 Fluvial (river) Flooding

The Environment Agency Surface Water flood map is representative of the fluvial flood risk posed to the Site. The Environment Agency Surface Water flood map shows that the Site has a very low risk (see Figure 4) with an annual probability of flooding of less than 1 in 1000 (0.1%) years.

The Environment Agency Surface Water flood map shows that the majority of the Site has a very low risk of surface water flooding (see Figure 4) with an annual probability of less than 1 in 1000 (0.1%) years. However, small areas of the Site are shown to have a low to medium risk of surface water flooding with an annual probability of flooding of between a 1 in 1000 (0.1%) and 1 in 100 (1%) years and 1 in 100 (1%) and 1 in 30 (3.3%) and may result in water depths of below 300mm.

The low to medium risk of surface water flooding is associated with drainage ditches within the vicinity of the Site and are confined to areas immediately adjacent to the drainage ditches. The flooding source will only inundate the site to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases and will not have an impact on the whole of the Proposed Development only affecting the northern area of the Site to the north of the proposed infrastructure.

Given the scale and nature of the proposed development and the size and location of the fluvial flooding sources it has been concluded that fluvial flooding poses a low flood risk to the Site and the risk of fluvial flooding is considered to be of **low significance**.

4.8 Tidal (coastal) Flooding

The Site is not located within the vicinity of tidal flooding sources and the risk of tidal flooding is considered to be **not significant.**

4.9 Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

Groundwater flooding tends to occur sporadically in both location and time. When groundwater flooding does occur, it tends to mostly affect low-lying areas, below surface infrastructure and buildings (for example, tunnels, basements and car parks) underlain by permeable rocks (aquifers).

Site ground conditions suggest a low potential for groundwater flooding, it is unlikely that rapid rises in groundwater levels would be facilitated through these deposits. Additionally, the topography of the site indicates that it is conductive to good drainage. A review of current and historical maps identified no springs within 500m of the Site. The natural or anthropogenic drainage network in the area does not suggest that large yielding springs are present in the area surrounding the Site and also no below surface buildings are proposed for the site. The risk of flooding from groundwater flooding is considered to be **not significant**.

4.10 Surface Water (pluvial) Flooding

The Site is not situated near to large areas of poor permeability which may result in surface water flooding. The Environment Agency Surface Water flood map shows that the majority of the Site has a very low risk of surface water flooding (see Figure 4) with an annual probability of flooding of less than 1 in 1000 (0.1%) years. However, a small proportion of the Site is shown to have a low to medium risk of surface water flooding with an annual probability of flooding of between a 1 in 1000 (0.1%) and 1 in 100 (1%) years and 1 in 100 (1%) and 1 in 30 (3.3%) and may result in water depths of below 300mm.

The low to medium risk of surface water flooding is associated with drainage ditches within the vicinity of the Site and are confirmed to areas immediately adjacent to the drainage ditches. The flooding source will only inundate the site to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases and will not have an impact on the whole of the Proposed Development only affecting the northern area of the Site to the north of the proposed infrastructure.

Given the scale and nature of the proposed development and the size and location of the surface water flooding sources it has been concluded that surface water flooding poses a low flood risk to the Site and the risk of surface water flooding is considered to be of **low significance**.

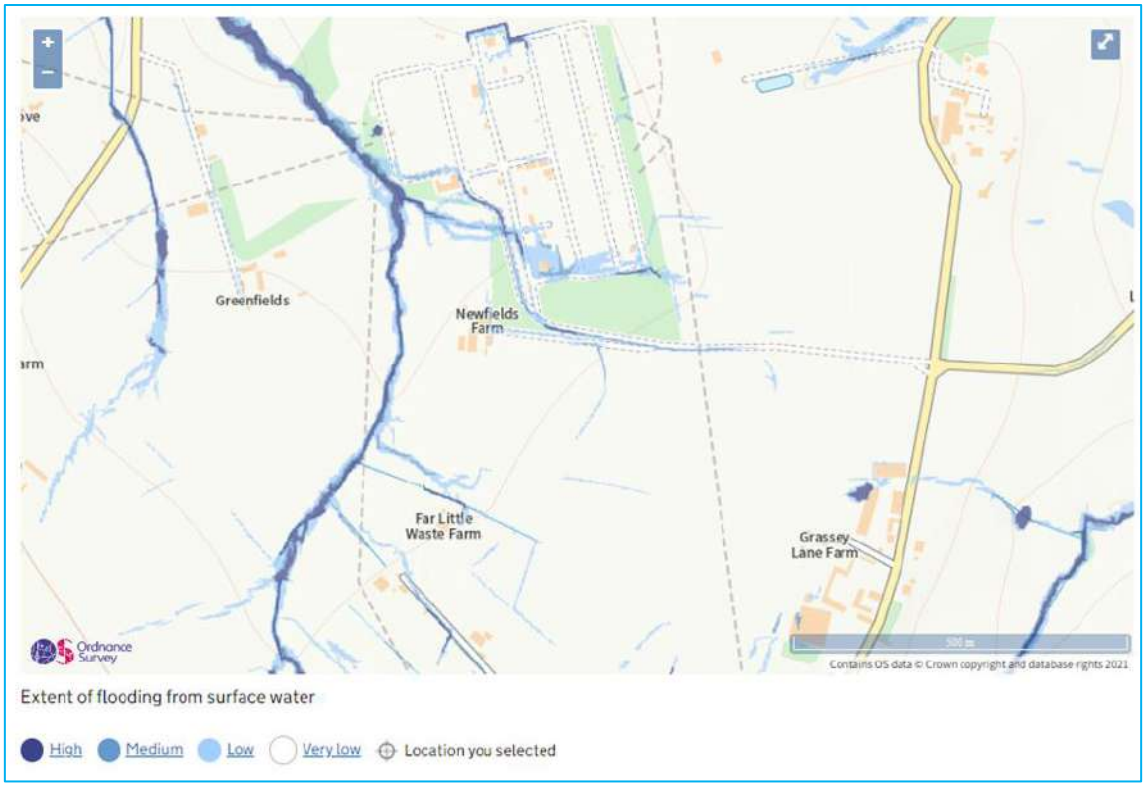


Figure 4 - Environment Agency Surface Water Flood Map

4.11 Sewer Flooding

Sewer flooding occurs when urban drainage networks become overwhelmed and maximum capacity is reached. This can occur if there is a blockage in the network causing water to back up behind it or if the sheer volume of water draining into the system is too great to be handled. Sewer flooding tends to occur sporadically in both location and time such flood flows would tend to be confined to the streets around the development.

Flood flows could also be generated by burst water mains, but these would tend to be of a restricted and much lower volume than weather generated events and so can be discounted for the purposes of this assessment. There are no public sewers located within the vicinity of the Site therefore, the risk of flooding from sewer flooding is considered to be **not significant**.

4.12 Flooding from Artificial Drainage Systems/Infrastructure Failure

There are no other nearby artificial water bodies, reservoirs, water channels and artificial drainage systems that could be considered a flood risk to the Site. The Environment Agency Reservoir flood map shows that the Site is not at risk of flooding from reservoir failure (see Figure 5). The risk of flooding from artificial drainage systems/infrastructure failure is considered to be **not significant**.

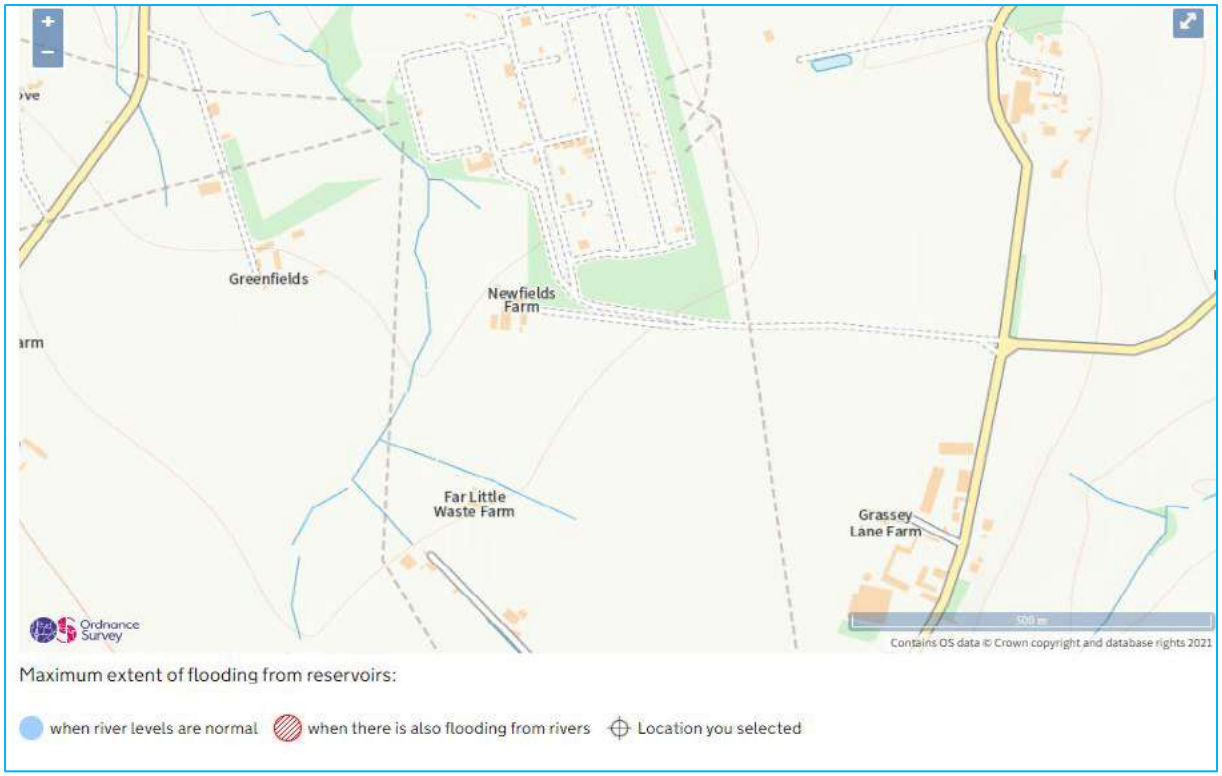


Figure 5 - Environment Agency Reservoir Flood Map

4.13 Summary of Site-Specific Flood Risk

A summary of the sources of flooding and a review of the risk posed by each source at the site is shown in Table 4. A number of flooding sources have been identified which may pose a **low significant** risk to the Site. These are:

- Fluvial Flooding
- Surface Water Flooding

The only element of the Proposed Development that is shown to be at risk of fluvial flooding is outside of the built area of the Site. The flooding sources will only inundate the site to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases and will not have an impact on the whole of the Proposed Development.

There will be no net loss in flood storage capacity or impact on movement of floodwater across the Site. The overall direction of the movement of water will be maintained within the developed Site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed.

The proposed use of the Site is 'essential infrastructure', 'essential infrastructure' uses are appropriate within Flood Zones 1 after the completion of a satisfactory FRA. In conclusion, the flood risk to the Site can be considered to be limited, with a low annual probability of flooding and from all sources. The Site is unlikely to flood except in very extreme conditions.

Table 4 - Risk Posed by Flooding Sources

Sources of Flooding	Potential Flood Risk	Potential Source	Probability/Significance
Fluvial Flooding	Yes	Drainage Ditch	Low
Tidal Flooding	No	None Reported	None
Groundwater Flooding	No	None Reported	None
Surface Water Flooding	Yes	Drainage Ditch	Low
Sewer Flooding	No	None Reported	None
Flooding from Artificial Drainage Systems/Infrastructure Failure	No	None Reported	None

5.0 SURFACE WATER DRAINAGE

5.1 Surface Water Management Overview

It is recognised that consideration of flood issues should not be confined to the floodplain. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. For example, replacing vegetated areas with roofs, roads and other paved areas can increase both the total and the peak flow of surface water runoff from the development site. Changes of land use on previously developed land can also have significant downstream impacts where the existing drainage system may not have sufficient capacity for the additional drainage.

An assessment of the surface water runoff rates has been undertaken, in order to determine the surface water options and attenuation requirements for the Site. The assessment considers the impact of the Proposed Development compared to current conditions. Therefore, the surface water attenuation requirement for the developed site can be determined and reviewed against existing arrangements.

The requirement for managing surface water runoff from developments depends on the predeveloped nature of the site. If it is an undeveloped greenfield site, then the impact of the development will need to be mitigated so that the runoff from the site replicates the natural drainage characteristics of the pre-developed site. The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development, unless specific offsite arrangements are made and result in the same net effect.

It should be acknowledged that the satisfactory collection, control and discharge of surface water runoff are now a principle planning and design consideration. This is reflected in implemented guidance as well as the Defra non-statutory technical standards for SuDS.

5.2 Climate Change

Projections of future climate change in the UK indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Guidance included within the NPPF (see Section 14) recommends that the effects of climate change are incorporated into FRA's. Recommended precautionary sensitivity ranges for peak rainfall intensities and peak river flows are outlined in the associated Planning Practice Guidance to the NPPF[4].

The recommended national precautionary sensitivity range for peak rainfall intensity are summarised in Table 5. The proposals will take into account a 40% increase in rainfall intensity due to climate change.

Table 5 - Peak Rainfall Intensity Allowance

Parameter	2050s	2070s
Upper end	+40%	+40%
Central	+25%	+30%

[4] Communities and Local Government (2014) Planning Practice Guidance - Flood Risk and Coastal Change.

5.3 Opportunities for Discharge of Surface Water

Possible receptors for runoff generated onsite have been assessed in line with the prioritisation set out in the Defra non-statutory technical standards for SuDS. There are four possible options to discharge the surface water. The Runoff Destination is (in order of preference):

a) To ground;

b) To surface water body;

c) To road drain or surface water sewer;

d) To combined sewer

It is necessary to identify the most appropriate method of controlling and discharging surface water. The design should seek to improve the local runoff profile by using systems that can either attenuate runoff and reduce peak flow rates or positively impact on the existing surface water runoff.

5.3.1 Discharge to Ground

In determining the future surface runoff from the Site, the potential of using infiltration has been considered. As detailed previously, information from the National Soil Resources Institute details the site area as being situated on slightly acid loamy and clayey soils with impeded drainage.

BRE 365 soakaway tests were carried out by a third party on 20th July 2022. Four trial pits were excavated at the Site. The infiltration testing results are presented in Appendix 2; these results indicate that no appreciable infiltration was observed at any of the trial pits (reflecting the fine grained nature of the encountered soils). As such, no representative infiltration rates have been calculated. Therefore, the ground conditions suggest infiltration would provide inception storage, but disposal of significant volumes of runoff may not be appropriate.

5.3.2 Discharge to Surface Water Body

Should infiltration be found to be unsuitable, the next option is discharge to a surface waterbody. A drainage ditch is located adjacent to the northern and western boundaries of the Site which ultimately discharge to Stanley Pool to the north west of the Site. Therefore, it would be possible to discharge surface water runoff from the site into a watercourse. This is the preferred option for the discharge of surface water runoff from the Site.

5.3.3 Discharge to Road Drain or Surface Water Sewer

This option is not required.

5.3.4 Discharge to a Combined Sewer

This option is not required.

5.3.5 Summary

For the purposes of this assessment the most likely scenario of discharging to the drainage ditch with attenuation and a restricted runoff rate is proposed. The ground conditions suggest infiltration would provide inception storage, but disposal of significant volumes of runoff may not be appropriate.

5.4 Surface Water Runoff

Currently the majority of rainfall infiltrates into the soil substrate and/or runoff from the Site. It is proposed that the Site will be surfaced with grass, crushed permeable stone and compacted impermeable stone or similar. The proposed impermeable area will total approximately 7,500m^2.

An estimation of surface water runoff is required to permit effective site surface water management and prevent any increase in flood risk to off-site receptors. In accordance with The SuDS Manual, the Greenfield runoff from the Site has been calculated using the IoH124 method[5]. Table 6 shows the IoH124 method Greenfield runoff rates calculated for the proposed impermeable area of 4,230m^2. The mean annual maximum flow rate from a Greenfield site (QBAR: approximately a 2.30 year return period) has been calculated to be 2.40 litres/second (l/s) (see Appendix 3).

Table 6 - IoH124 Method Greenfield Runoff Rates

Rainfall Event	Runoff Rate (l/s)
1	2.00
QBAR (rural)	2.40
30	4.80
100	6.30

The method used for calculating the runoff complies with the NPPF, as well as the new Defra non-statutory technical standards for SuDS, and assumes that the excess runoff associated with the Proposed Development (plus an allowance for future climate change) will need to be managed by the proposed SuDS scheme.

5.5 SuDS Strategy

One of the aims of the NPPF is to provide not only flood risk mitigation but also to maximise additional gains such as improvements in runoff quality and provision of amenity and biodiversity. Systems incorporating these features are often termed SuDS and it is the requirement of NPPF that these are considered as the primary means of collection, control and disposal for storm water as close to source as possible.

The objective of this SuDS Strategy is to ensure that a sustainable drainage solution can be achieved which reduces the peak discharge rate to manage and reduce the flood risk posed by the surface water runoff from the site. The SuDS Strategy takes into account the following principles:

- No increase in the volume or runoff rate of surface water runoff from the Site.
- No increase in flooding to people or property off-site as a result of the Proposed Development.
- No surface water flooding of the Site.
- The proposals take into account a 40% increase in rainfall intensity due to climate change during the lifetime of the development.

In line with adopting a 'management train' it is recommended that water is managed as close to source as possible. This will reduce the size and cost of infrastructure further downstream and also shares the maintenance burden more equitably. The proposed SuDS Strategy will take the form of:

- Permeable surfaces - crushed permeable stone and grass.

[5] Institute of Hydrology, Flood Estimation of Small Catchments, June 1994.

- Surface water attenuation storage in the form of underground crate system attenuation tank. Runoff rates would be restricted to 5.00l/s to the drainage ditch to the north west corner of the site.

One of the aims of the NPPF is to provide not only flood risk mitigation but also to maximise additional gains such as improvements in runoff quality and provision of amenity and bio-diversity. Systems incorporating these features are often termed SuDS and it is the requirement of NPPF that these are considered as the primary means of collection, control and disposal for storm water as close to source as possible.

The principle applied in the design of storage is to limit the discharge rate of surface water runoff from the developed site for events of similar frequency of occurrence to the same peak rate of runoff as that which takes place from a greenfield site prior to development. It would not be practical to include a pond, or lagoon within the site it would also not be sustainable to install a green roof on the buildings/structures.

The SuDS Strategy is shown in Appendix 4. This Strategy will reduce peak flows, the volume of runoff, and slow down flows and will provide a suitable SuDS solution for this site. The adoption of a SuDS Strategy for the site represents an enhancement from the current conditions as the current surface water runoff from the site is uncontrolled, untreated, unmanaged and unmitigated. In adopting these principles, it has been demonstrated that a scheme can be developed that does not increase the risk of flooding to adjacent properties and development further downstream.

The equipment will sit on concrete rafts, the apron in front of the equipment will be constructed from compacted impermeable surfaces. These areas, where possible, will be constructed to shed water to any adjacent permeable areas. The rest of the site will be constructed from free draining stone or grass which will allow infiltration of rainfall.

The free draining stone will have a sufficient void ratio of 30% and permeability of granular fill to allow adequate percolation and to control the risk of blockage (examples include coarse aggregate 4-40mm (4/40), 4-20mm (4/20) as defined in BS 753313:2009 or Type 3 sub-base 0-40mm (0/40)). A permeable/open-graded (reduced fines) sub-base layer (i.e. Type 3 with a void ratio of 30%) will be used as a drainage layer below the permeable surfaces which will be sufficiently permeable to allow water to drain through and to store water temporarily. The selected gravel fill and bedding would be clean, free-draining, angular shaped material in the specified size range.

Infiltration capacities of free draining stone are significantly greater than the design rainfall intensities and are not a limiting factor. A minimum value of 2500mm/hr is considered reasonable within The SuDS Manual (see Section 20.5.1 of the SuDS Manual). These are SuDS source control compliant and will as a minimum provide storage for the first 5mm (interception storage). Permeable surfaces, together with their associated substructures, are an efficient means of managing surface water runoff close to its source – intercepting runoff, reducing the volume and frequency of runoff, and providing a treatment medium. These systems encourage biological treatment of flow and extraction of oils and heavy metals from the runoff. Treatment processes that occur within the surface structure and the geotextile layers include:

- Filtration
- Absorption
- Biodegradation
- Sedimentation

It will also assist in reducing the flood profile of the site by significantly attenuating the runoff from the proposed development within the sub-base material.

It is proposed that an underground crate system attenuation tank will be used to provide the required attenuation storage volume for the impermeable areas consisting of the equipment and roadways within the Site. Additional storage would be provided within the manholes and pipes which will provide betterment over and above the 1 in 100 year (+40%) event.

The QBAR runoff rate has been calculated to be 2.40l/s. A value of 5.00l/s has been used as the limiting discharge rate before discharge off the Site. Appendix 5 shows the drainage network and volume of storage required for the proposed development estimated within the MicroDrainage Software for the 1 in 100 year event, with a 40% allowance for climate change (increase in peak rainfall) with 5.00l/s used as the limiting discharge rate before discharge off the Site.

Given the nature of the energy storage within the proposed development, there is a potential risk of fire which may negatively affect upon the local water environment by mobilising pollution within surface water runoff, ultimately discharging to the nearby watercourses or infiltrating to ground. Fire risk and negative effects on the local water environment will be minimised by ensuring that firewater run-off is contained and treated, with measures in place which will be detailed within the Emergency Response Plan, such as the valve to the attenuation tank being turned off to ensure no contaminated fire water gets into the system and the provision of a gravel sump and oil interceptor underneath the BESS compound to capture pollutants.

5.6 Designing for Local Drainage System Failure

When considering residual risk, it is necessary to make predictions as to the impacts of a storm event that exceeds the design event, or the impact of a failure of the local drainage system. The SuDS Strategy applies a safe and sustainable approach to discharging rainfall runoff from the site and this reduces the risk of flooding however, it is not possible to completely remove the risk.

As part of the SuDS Strategy it must be demonstrated that the flooding of property would not occur in the event of local drainage system failure and/or design exceedance. It is not economically viable or sustainable to build a drainage system that can accommodate the most extreme events. Consequently, the capacity of the drainage system may be exceeded on rare occasions, with excess water flowing above ground. However, this is considered unlikely in the immediate future due to the 40% allowance for climate change used in the calculations.

The design of the Proposed Development provides an opportunity to manage this local drainage system failure/exceedance flow and ensure that indiscriminate flooding of property does not occur. There will not be an extensive sewerage network on the Proposed Development and therefore any potential exceedance flooding would be from the sewers and lateral drains connecting the impermeable areas to the storage areas. It is very unlikely that a catastrophic failure would occur. An exceedance or blockage event of the sewers would not affect the proposed buildings/structures because the finished floor level will be raised above surrounding ground levels, ensuring any exceedance flooding would not affect the buildings/structures. Exceedance flows would be contained within the permeable areas within the site and would flow to the lower ground levels. It is not considered that there is an increased risk to the site or properties located adjacent to the site.

Surface water runoff would be directed to the drainage system through drainage gullies located around the perimeter of the structures and through contouring of the hardstanding areas. When considering the impacts of a storm event that exceeds the design event, there is safety factor, even under the design event conditions. Consequently, if this event were to be exceeded there is additional capacity with the system to accommodate this (i.e. within the manholes, pipes etc.). If this freeboard was to be exceeded the consequences would be similar, if not less than for the local drainage system

failure. Consequently, the impact of an exceedance event is not considered to represent any significant flood hazard.

The above manages and mitigates the flood risk from surface water runoff to the adjacent premises and site infrastructure from surface water runoff generated by the Proposed Development.

6.0 SEQUENTIAL APPROACH

6.1 Sequential and Exception Tests

The Sequential Test ensures that a sequential, risk-based approach is followed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account. The approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The flood risk to the Site can be considered to be limited; the Site is situated in Flood Zone 1, with a low annual probability of flooding and from all sources. The Site is unlikely to flood except in very extreme conditions. Therefore, the Sequential and Exception Tests will not need to be undertaken as part of this planning application.

7.0 CONCLUSIONS

7.1 Conclusion

In conclusion, the Site would be expected to remain dry in all but the most extreme conditions. The Proposed Development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF. The Proposed Development will considerably reduce the flood risk posed to the Site and to off-site locations due to the adoption of a SuDS Strategy.

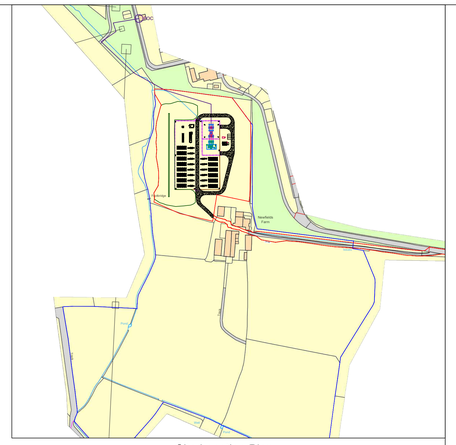
The Proposed Development should not therefore be precluded on the grounds of flood risk or drainage.

APPENDIX 1 – Proposed Site Layout

N
W E
S

Footbridge

Scale - 1:200



Site Location Plan
Scale: 1:3000

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS AND SPECIALISTS DRAWINGS & SPECIFICATIONS.

2. ANY DISCREPANCIES BETWEEN THIS DRAWING AND ANY OTHER TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

3. ALL WORKS TO COMPLY WITH THE MOST CURRENT BRITISH STANDARDS.

4. ALL DIMENSIONS IN MILLIMETERS UNLESS STATED OTHERWISE. NO DIMENSIONS ARE TO BE SCALED OFF THE DRAWING. USE FIGURED DIMENSIONS ONLY.

5. ALL DIMENSIONS TO BE ±3mm UNLESS SPECIFIED OTHERWISE.

6. A RECESSIVE COLOUR SUCH AS GREY IS PROPOSED, BUT CAN BE AGREED WITH OFFICERS.

Legend:

- LAND UNDER OWNERSHIP OF THE APPLICANT
- SITE BOUNDARY
- FENCE
- OVERHEAD LINE
- HV UNDERGROUND CABLE ROUTE
- CULVERTED DRAINAGE DITCH
- ACCESS ROAD
- INTERNAL STONE ROAD
- ACOUSTIC FENCE - APPROX. 4m HEIGHT
- ACOUSTIC FENCE - APPROX. 2m HEIGHT
- ACOUSTIC BUND - APPROX. 3m HEIGHT
- ENTRANCE GATE
- CAR PARKING SPACES
- 5.0m CCTV CAMERA COLUMN
- TREES WITH ROOT PROTECTION AREA

BESS Equipment Legend:

- 132/33 kV SWITCHYARD
- DNO CONTROL BUILDING
- DNO STORE BUILDING
- BATTERY ENERGY STORAGE RACKS
- SKID SOLUTION (INVERTER + TRANSFORMER)
- CUSTOMER SWITCHROOM
- CUSTOMER CONTROL BUILDING
- CUSTOMER STORE BUILDING
- AUXILIARY TRANSFORMER

0 10 20 30 40
meters

Project: Newfields Farm BESS
Drawing name: Overall Site Layout
No: 88-10-05-PL-LA-OA
Drawn: REN

Revision	Description	Date
R.06	Access Road Modified	17.11.2023
R.05	Acoustic Bund and Fence Added	12.10.2023
R.04	Planning Zone Modified	19.06.2023
R.03	Fluence BESS Design	02.03.2023
R.09	Red Line Amended	02.01.2024
R.08	Additional Acoustic Fence Added	29.11.2023
R.07	Site Boundary Modified	28.11.2023

Discipline: Electrical | Phase: FOR PLANNING | Format: A0 | Scale: 1:200 | Sheet No: 01 / 01

Client: RE Project Development Limited

RENERGY LTD
28 E Samokov str.
1113 Sofia, Bulgaria
info@renergy-bg.com
www.renergy-bg.com

APPENDIX 2 – BRE 365 Soakaway Tests

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.423	Urban	0.000
SAAR (mm)	883	Region Number	Region 4

Results l/s

QBAR Rural	2.4
QBAR Urban	2.4
Q100 years	6.3
Q1 year	2.0
Q30 years	4.8
Q100 years	6.3

APPENDIX 3 – IoH 124 Method Calculations

Groundfirst

Reliable ground quality advice

Infiltration testing: Newfields Farm, Rownall Road, Wetley Rocks

Prepared for: RE Projects Development Ltd.
565 High Road
Leytonstone
London
E11 4PB

Report reference: 4272R1

Date of reporting: 21st July 2022

Report status: Final report

Prepared by
Ground First Ltd

26 Victoria Street, Castlefields, Shrewsbury, SY1 2HS
Tel: 07484 542827
email: info@groundfirst.com
Registered in England and Wales, number 10418394

Groundfirst

Reliable ground quality advice

Infiltration testing: Newfields Farm, Rownall Road, Wetley Rocks

Revision record:

Issue	Date	Status	Comment	Author	Recipient
1	21st July 2022	Final		AJS	RE Projects Development Ltd.

Prepared by
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CONTENTS

FIGURES

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APPENDICES

1 INTRODUCTION

1.1 Background

Planning permission is being sought from Staffordshire Moorlands District Council (application ref: SMD/2022/0180) for the '*development of a Battery Energy Storage System (BESS) with ancillary infrastructure, security fence, access, landscaping and biodiversity enhancements'* at Newfields Farm near Wetley Rocks in Staffordshire (herein referred to as the 'Site'). The Site location is shown on Figure 1.1. The proposed development plan is shown on Figure 1.2.

In support of the planning process KRS Environmental Ltd prepared a flood risk and surface water drainage assessment report for the study Site in March 2022. The KRS report identified two drainage options; discharge to ground is the preferred approach (option 1), although discharge to an adjacent water course (option 2) may be required, should infiltration to ground be unfeasible.

A consultation response provided by the Lead Local Flood Authority (Staffordshire County Council) on 16th May 2022 provided the following recommendations:

- *Infiltration testing to BRE 365 standards should be undertaken to confirm the suitability of the ground conditions for infiltration methods for surface water drainage option 1.*
- *The results from the infiltration testing shall determine the confirmation of the final drainage option in line with the hierarchy of surface water disposal as described in Part H of the Building Regulations.*

1.2 Instruction

Ground First was instructed by Third Revolution Projects Ltd., on behalf of RE Project Developments Ltd., on 24th June 2022 to undertake infiltration testing as outlined in proposal reference 4272P1.

1.3 Objectives

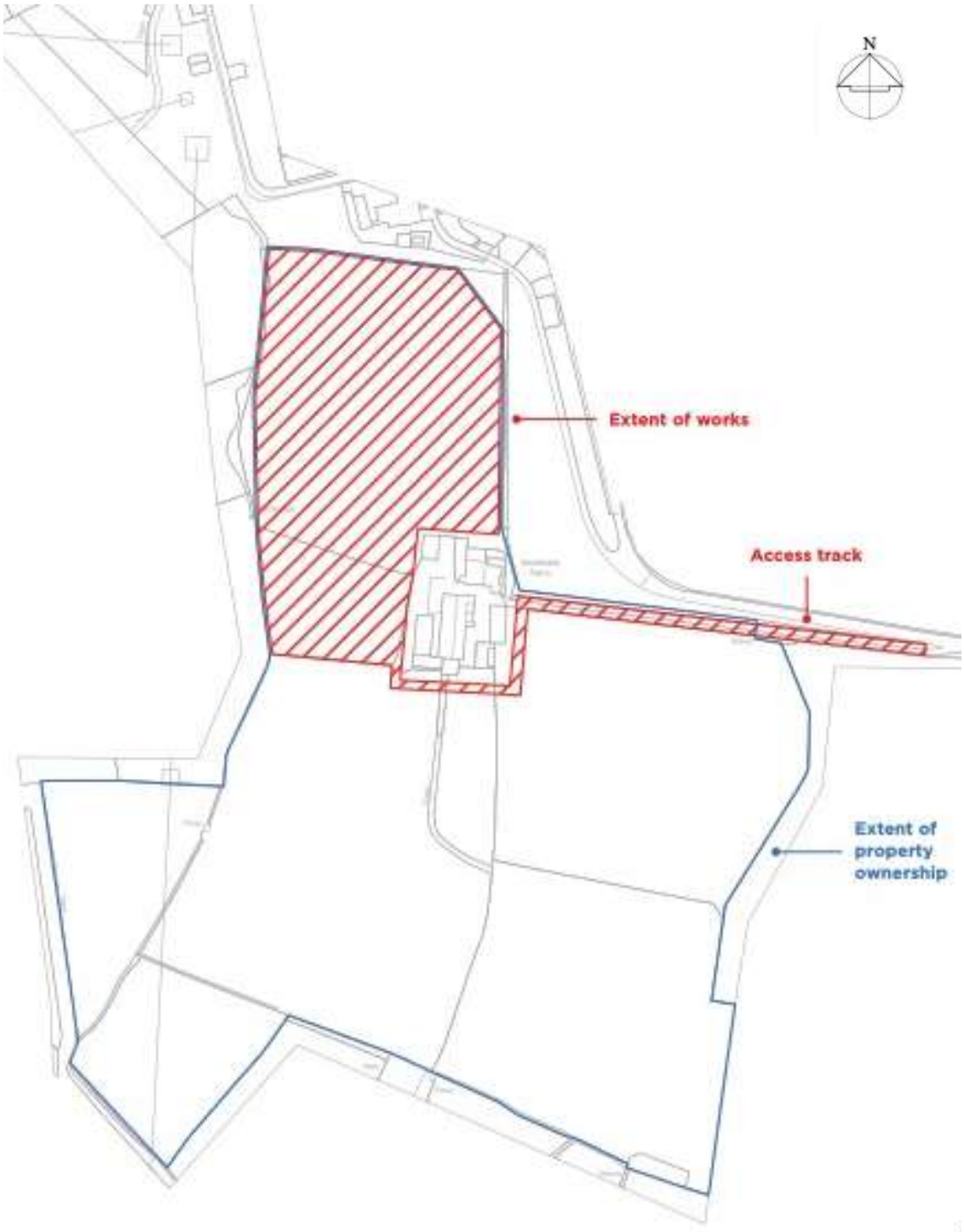
The objective of the work was to undertake appropriate site investigations designed to determine representative soil infiltration rates in line with the requirements of BRE Digest 365 (Soakaway Design).

It is understood that the infiltration rate information will be used by a third-party consultant to further inform a suitable drainage design in line with the requirements of the Lead Local Flood Authority.

1.4 This report

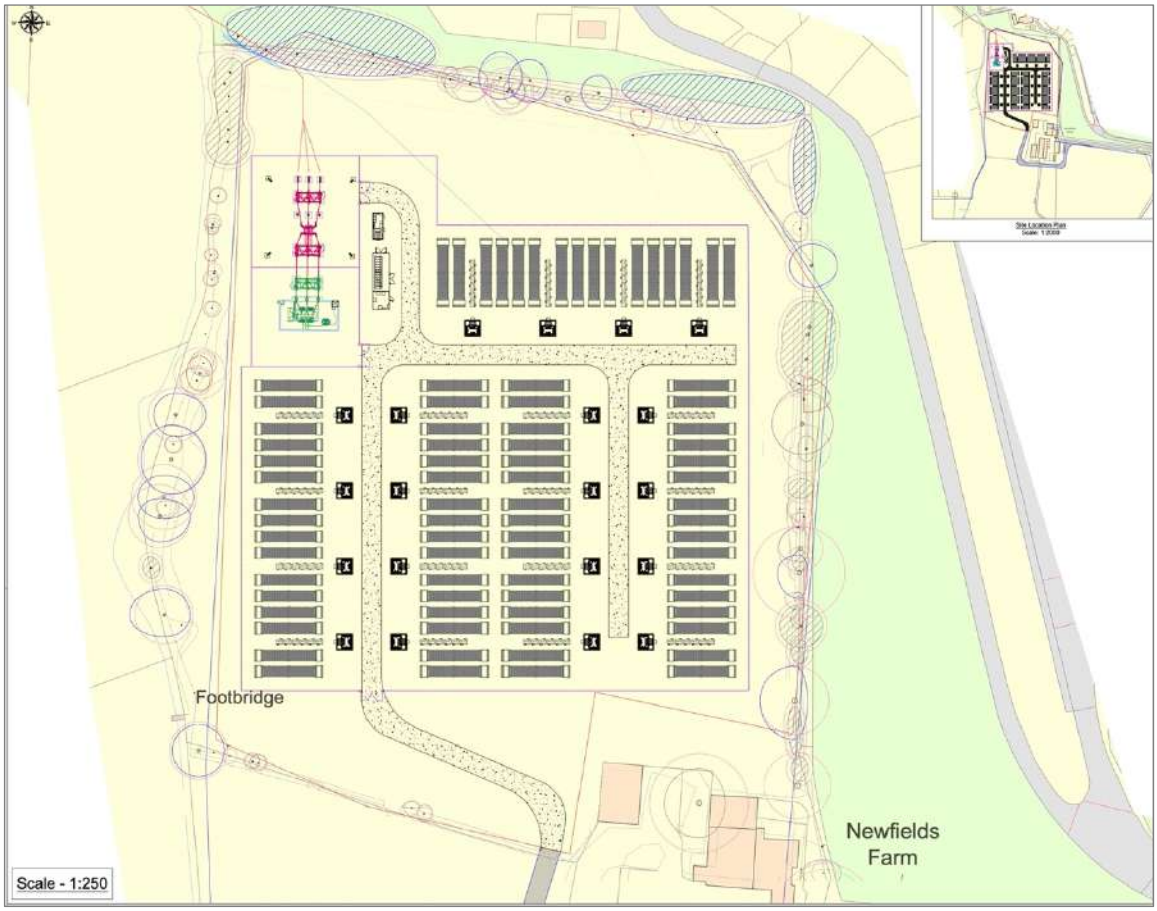
This report provides factual records of all relevant fieldwork observations and test results as well as indicative soil infiltration rates.

Figure 1.1 Site location plan



Site location	**July 2022**	**Drawn: AJS**
	4272R1	**Rev 1**

Figure 1.2 Development plan



Legend:

- Site boundary
- Construction Area
- Fence
- Access Road
- Internal Stone Road

BESS Equipment Legend:

- 132/33 kV Grid Connected Switch Yard
- 40ft. Battery Container (80 Units)
- DNO Substation
- MV Transformer (20 units)
- PCS - Power Conversion System (120 units)
- Customer Control/Switchgear Building

Development plan: BESS facility	**July 2022**	**Drawn: AJS**
	4272R1	**Rev 1**

2 SITE SETTING AND HISTORY

The following section provides a summary of the Site setting, land use history and local geological and hydrological conditions.

2.1 Basic site information

Information relating to the Site location is summarised in Table 2.1.

Table 2.1 Site details

Site Address	Newfields Farm BESS, Rownall Road, Wetley Rocks, Stoke on Trent, Staffordshire, ST9 0BS
Site area	c. 2.1 hectares
General setting and ground coverage	The Site is located within a predominantly rural land use setting c. 1.2 km to the north of Werrington. An existing electricity sub-station is positioned to the north and east of the Site. Structures associated with Newfields Farm are positioned directly to the south-east of the Site. The Site topography generally slopes down towards the north-west. The high point of the Site is located in the south-east corner at an elevation of c. 231 m AOD. The ground level in the north-west corner of the Site is c. 223 m AOD. Photographs of the current Site condition are included in Appendix A.

2.2 Site history

Available historical land use maps suggest that the Site has remained undeveloped during the last 100 years. Aerial photography indicates that the Site has been occupied by grassed fields, potentially used for animal pasture, since at least 2003.

Note: no historical landfills are mapped by the Environment Agency at or within 100 m of the Site.

2.3 Geological setting

British Geological Survey mapping (BGS, 2022) indicates that the Site and surrounding land area is underlain by superficial deposits comprising of Till (diamicton). The bedrock deposits comprise predominantly of the Morridge Formation group (mudstone, siltstone and sandstone), with a possible sub crop of Kniveden Sandstone in the south-west corner of the Site.

The nearest available BGS borehole record relates to borehole ref: SJ94NW13 located c. 500 m to the south of the Site (within the boundaries of Newfields Farm). The borehole was drilled to a depth of around 21.9 m in 1961; the encountered geological sequence comprised c. 0.6 m of ‘soil’, 0.6 m of ‘rock’, 3.1 m of blue marl and over 17 m of very hard sandstone. The borehole record showed a rest groundwater level of c. 8 m bgl.

Note: several confidential BGS records exist for boreholes previously drilled on the site of the neighbouring electricity sub station. Further to an email enquiry, the BGS has confirmed that these borehole records cannot be supplied without the permission of National Grid.

The following additional information regarding in-situ ground conditions is presented within KRS Environmental’s flood and drainage report (KRS, 2022):

- Information from the National Soil Resources Institute details the site area as being situated on slowly permeable, seasonally wet acid loamy and clayey soils with impeded drainage.

- The Wallingford Winter Rain Acceptance Potential (WRAP) map indicates that the site lies within WRAP Class 4: clayey, or loamy over clayey soils with an impermeable layer at shallow depth.
- Site ground conditions suggest a low potential for groundwater flooding.

2.4 Hydrological setting

OS mapping shows the presence of a surface water channel positioned alongside the western Site boundary (see Figure 3.1); this feature ultimately discharges into Stanley Pool, located c. 2.4 km to the north. A potential surface water channel is also mapped in the north-west corner of the Site; this appears to be a perennial water feature which drains into the surface water channel located along the western Site boundary. A recent topographic survey identified further drainage ditches along the southern and eastern Site boundaries (see Figure 3.1).

3 SITE INVESTIGATION WORKS

3.1 Site investigation programme

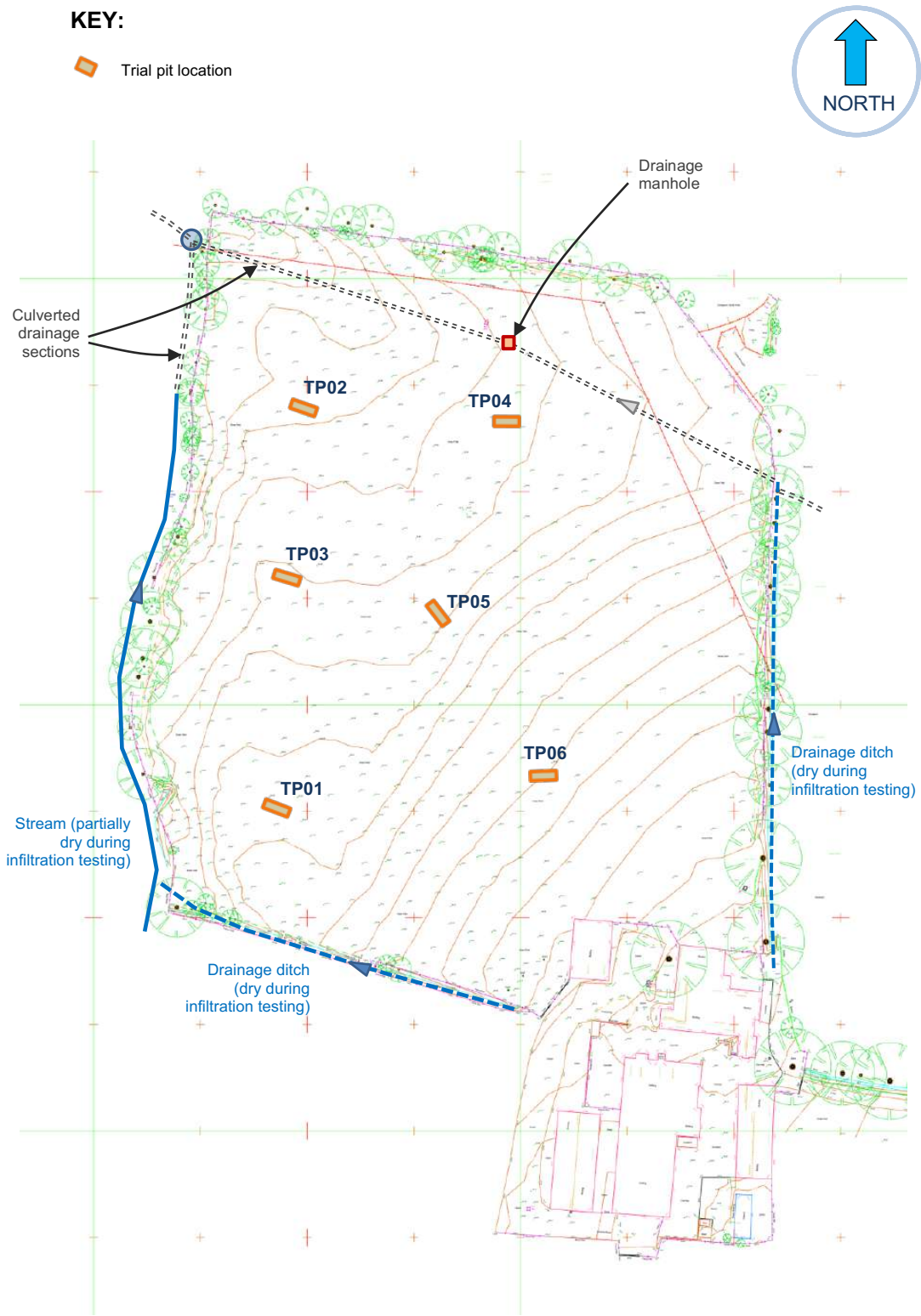
Trial pitting and infiltration testing was coordinated by Ground First at the study site on 20th July 2022. The purpose of the infiltration testing was to characterise the infiltration / drainage capabilities of the shallow sub strata.

A summary of the site investigation activities undertaken is presented in Table 3.1. The site investigation locations are shown on Figure 3.1. A photographic record of the Site works is provided in Appendix A.

Table 3.1 Site investigation activities

Element of investigation	Details	Comments / rationale
Utilities and service avoidance	Prior to undertaking the site investigation works gas and electricity service plans were obtained for the Site; no buried services were mapped on-Site. All exploratory trial pit locations were checked with a CAT scan prior to the intrusive works.	To minimise the potential for encountering buried services during the intrusive site investigation works.
Trial pitting	Six trial pits (TP01 to TP06) were excavated at the study Site using a tracked 3.5 tonne excavator. The sides and bases of each excavation were trimmed to make the pits as rectangular as practically possible. The pits were positioned in order to provide an indication of ground conditions across the Site, including the lower lying areas in the south-west and north-west. The trial pit locations are shown on Figure 3.1. The pits were excavated to depths of between 2.1 m and 2.4 m bgl. Note: all trial pits were observed to be stable; i.e., no collapse was observed within any of the trial excavations. All of the trial pits were backfilled on completion. The excavated spoil was replaced in broadly the same order as it was excavated. The backfilled spoil was compacted with a small mound left at each location. All excavated materials were logged by an experienced site supervisor (see Appendix B).	To assess the extent, thickness and composition of any Made Ground. To assess the composition of the natural superficial geology. To clarify the depth to any shallow groundwater. To make a visual assessment of any ground contamination. To enable infiltration testing.
Infiltration testing	Infiltration testing was carried out in accordance with BRE 365 (2016) at four of the trial pits (TP01, TP02, TP03 and TP04); these locations were all located at relatively low elevations in the north and west of the Site. A 1,300 gallon water bowser was used to discharge water into the pits using a wide diameter hose. The excavations were all filled in less than 60 seconds. Water level measurements were taken within each excavation using a dip tape at regular intervals following the cessation of infilling. Note: the residual water was pumped out of the trial pits prior to backfilling.	To enable representative infiltration rates to be calculated.

Figure 3.1 Site investigation location plan



Indicative site investigation locations plus salient field observations	**July 2022**	**Drawn: AJS**
	4272R1	**Rev 1**