GeoSmart Information

SuDSmart Plus

Sustainable Drainage Assessment

Site Address

Northfield Farm
Withington Road
Andoversford
GL54 4LL

Grid Reference

402810E, 217230N

Report Prepared for

Agrarian Ltd
Walgaston
Mobley
Berkeley
Gloucestshire
GL13 9EN

Date

2021-07-16

Report Status

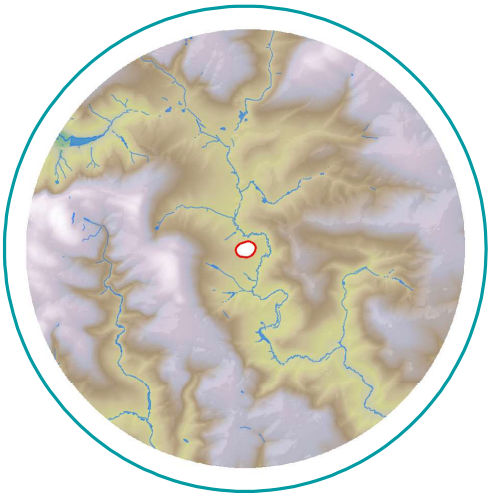
FINAL

Site Area

1.33 ha

Report Reference

74441.01R2



Infiltrate to ground

The proposed Sustainable Drainage Scheme (SuDS) strategy is comprised of rainwater harvesting butts, permeable paving, swales and an infiltration basin for surface water runoff. This will attenuate the 1 in 100 plus 40% climate change event.

The final sizing and configuration of the SuDS strategy is subject to the results of on-site infiltration testing.

Report Author

James Robinson

Consultant

Report Checker

Alan White

Principal Consultant

Report Reviewer

Bob Sargent

Associate

GeoSmart Information Ltd
Suite 9-11, 1st Floor, Old Bank Buildings,
Bellstone, Shrewsbury, SY1 1HU
+44(0)1743 298 100
info@geosmartinfo.co.uk
www.geosmartinfo.co.uk

1 Executive summary

This report assesses the feasibility of a range of Sustainable Drainage Scheme (SuDS) options in support of the Site development process. A SuDS strategy is proposed to ensure surface water runoff can be managed effectively over the lifetime of the development.

SuDS suitability

Risk	Issue	Result
Discharge Location	What is the infiltration potential at the Site?	High
	What is the potential to discharge to surface water features?	Low
	What is the potential to discharge to sewers?	Low
	What is the potential to discharge to highway drains?	Low
Flooding	What is the river (fluvial) flood risk at the Site?	Very Low
	What is the surface water (pluvial) flood risk at the Site?	Very Low
	What is the groundwater flood risk at the Site?	Negligible
Pollution	Is the groundwater a protected resource?	Yes
	Is the surface water feature a protected resource?	N/A

Summary of existing and proposed development

The Site is currently a disused farm. Development proposals comprise the conversion of 5 barns into residential dwellings.

Summary of discharge routes

GeoSmart's SuDS Infiltration Potential (SD50) map indicates the Site has a High potential for infiltration, primarily due to the high permeability of the underlying geology. Infiltration to ground is therefore likely to be feasible.

Ordnance Survey (OS) mapping indicates there is no surface water feature within 100 m of the Site and therefore discharge to surface water is not considered feasible.

The regulated drainage and water search included in Appendix C confirms the Site is not located within 100 m of a public sewer network. Therefore, discharge to sewer is not proposed.

Google Streetview was not available for the track up to the Site, it is assumed that there is no highway drainage network.

Runoff rate and attenuation requirements

Discharging via infiltration requires 267.73 m^3 of attenuation to be provided to ensure there is no flooding as a result of the development in all storm events up to and including the 1 in 100 year including a 40% allowance for climate change. This volume is subject to the results of infiltration testing and would ensure runoff is not increased above the greenfield scenario.

Discharging off-Site is not considered feasible due to the absence of surface watercourse, public sewer network or highway drain.

Proposed SuDS strategy

SuDS features comprised of rainwater harvesting butts, permeable paving, swales and an infiltration basin are proposed to attenuate a minimum of 271.0 m^3 of surface water runoff providing 3.27 m^3 of freeboard storage. The SuDS features would provide some water quality benefits (interception and filtration) prior to infiltrating to ground. Focused infiltration features should be sited at least 5 m from building foundations.

The proposed SuDS strategy would ensure surface water runoff is stored on-Site in SuDS features for the 1 in 100 year event including a 40% allowance for climate change and will not cause flooding to the proposed development in accordance with DEFRAs non-statutory technical standards (DEFRA, 2015).

SuDS & drainage network maintenance

The management and maintenance of the SuDS features, in line with the details and schedules outlined in Section 10 of this report, will be undertaken by contractors appointed by the owners and occupiers of the new residential buildings, where payments for the works will form part of the property deeds and / or rental agreements.

Recommendations / Next steps

A site investigation is required to confirm the infiltration capacity of the ground in line with BRE 365 guidelines to confirm the infiltration rate and groundwater level.

2 Proposed SuDS strategy

The most suitable SuDS options are outlined below and a SuDS strategy schematic is shown overleaf. Supporting information is provided in subsequent sections.

Table 1. Proposed SuDS type, features, discharge location and rate restriction

SuDS type	Source control (interception) and infiltration SuDS.
SuDS features	Rainwater harvesting butts, permeable paving, swales and a infiltration basin
Discharge location	Infiltrate to ground

Table 2. Proposed SuDS sizing (dimensions) and attenuation volumes

Rainwater harvesting	Rainwater harvesting butts should be established for each proposed development. In terms of attenuation storage within this SuDS scheme, the volume of run-off which could be attenuated by rainwater harvesting has not been considered within the Preliminary SuDS schematic.
Permeable paving	A 1,050 m^2 area of permeable paving (underlain with a Type 3 aggregate material) within the proposed access road and parking bays to a depth of 0.4 m, with a 30% porosity would result in c. 126 m^3 attenuation.
Swale	Two swales with a length of 40 m, width of 3.5 m, basal width of 0.5 m and depth of 0.5 m along the southern boundary of the proposed development would result in c. 80 m^3 attenuation.
Infiltration basin	An infiltration basin with a surface area of 65 m^2 and an average depth of 1m would provide c. 65 m^3 attenuation. The final sizing of the basin will be subject to the outcome of infiltration testing. Following the results of testing this should include a freeboard above the full level to allow for settlement.
Total Attenuation Provided	271.0 m^3
Total Attenuation Required	267.73 m^3
Freeboard Storage Provided	3.27 m^3

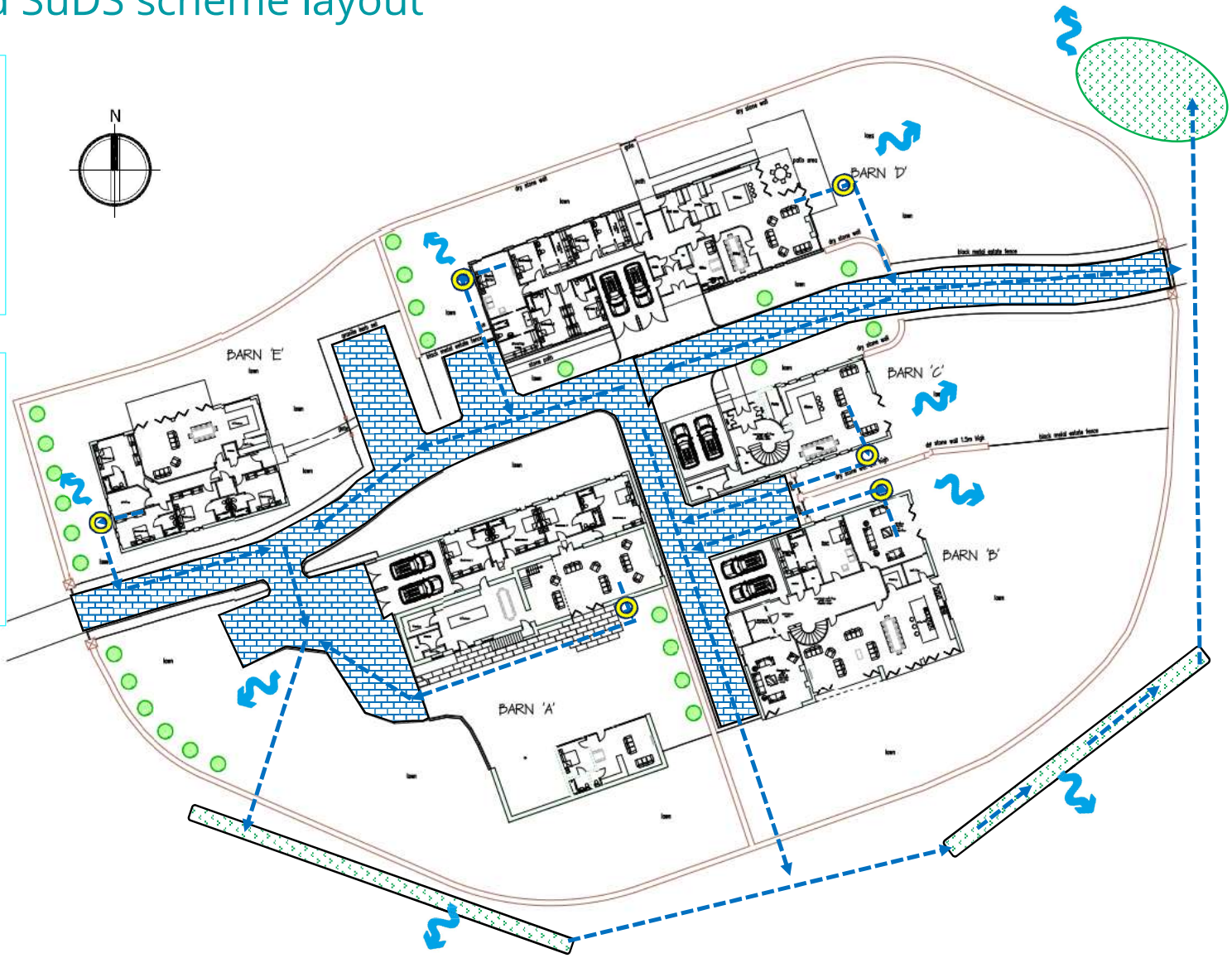
Figure 1. Proposed SuDS scheme layout

- Permeable paving
- Infiltration basin
- Rainwater harvesting butt
- Swale
- Surface water drainage network
- Exceedance flow routes

Surface water runoff from the proposed development will be captured by guttering and a downpipe network to be conveyed into the proposed rainwater harvesting butt and permeable paving. This will then be conveyed into the proposed swales and infiltration basin where it will be infiltrated to ground.

The final sizing and configuration of the proposed features will be confirmed following infiltration testing.

Schematic is not to scale



3 Site analysis

Site location

Figure 2. Aerial Imagery (Bluesky, 2021)

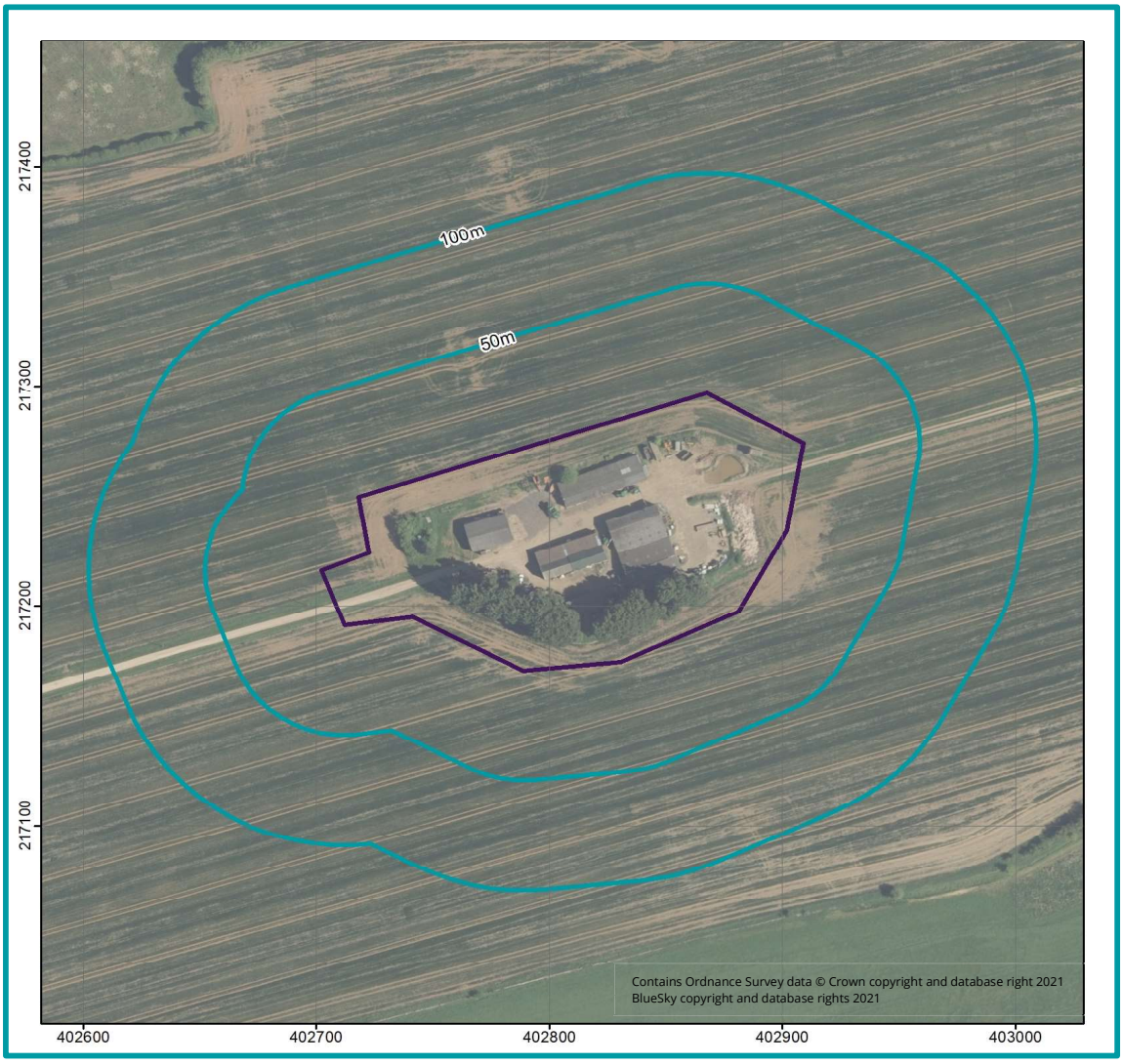
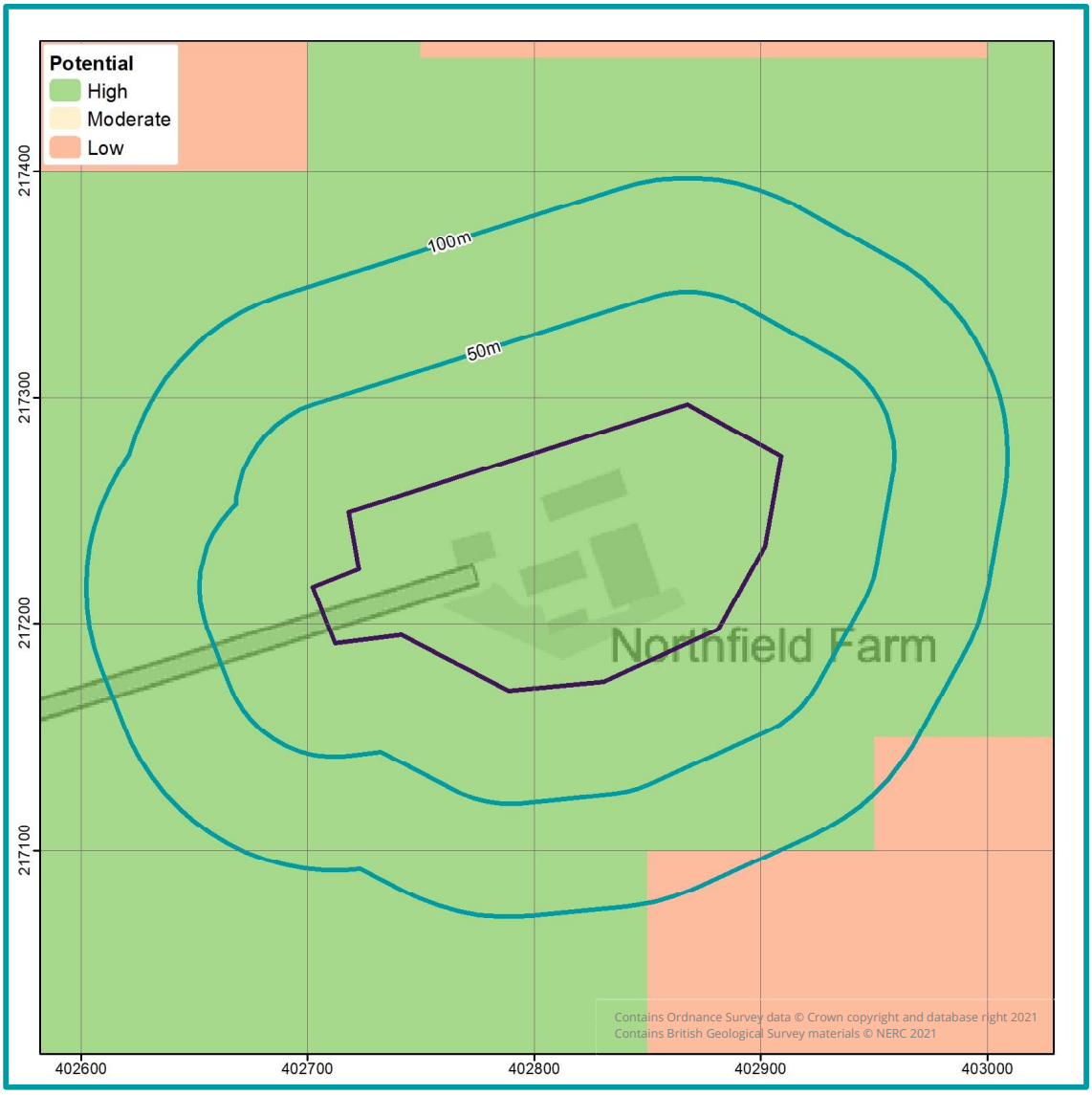


Figure 3. SuDS infiltration suitability (SD50) map (GeoSmart, 2021)



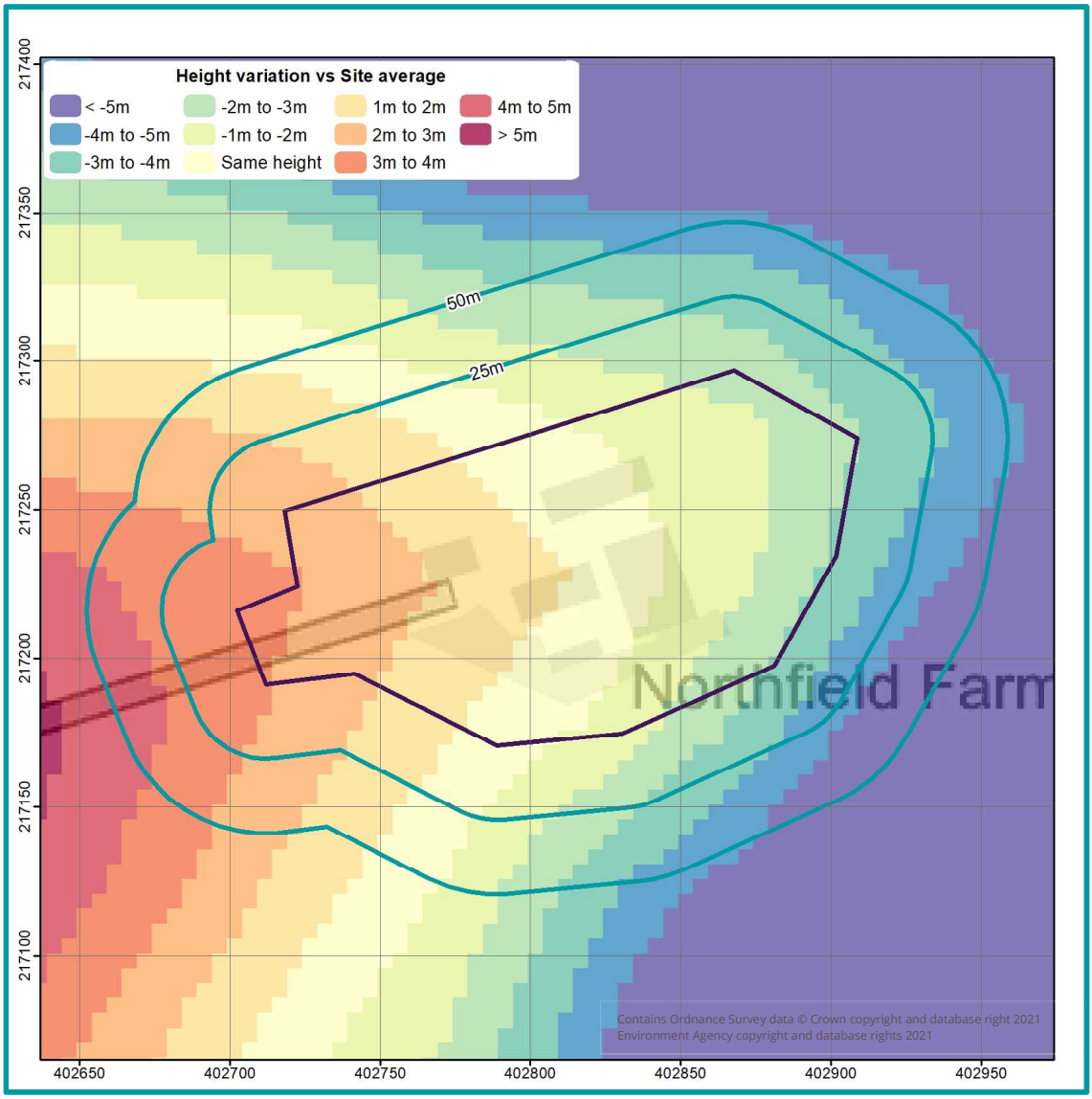
The GeoSmart SuDS Infiltration Suitability Map (SD50) screens the potential for infiltration drainage at the Site and indicates where further assessment is recommended. The map combines information on the thickness and permeability of the underlying material and the depth to the high groundwater table. It supports conceptual Site drainage design and the planning of further Site investigation.

There is a High potential for infiltration SuDS across the Site. It is likely that the underlying geology at the Site has high permeability and an infiltration SuDS scheme is likely to be possible at the Site.

Groundwater levels are expected to be sufficiently deep at the Site. Although, a Site Investigation is recommended to confirm the infiltration capacity and the depth to

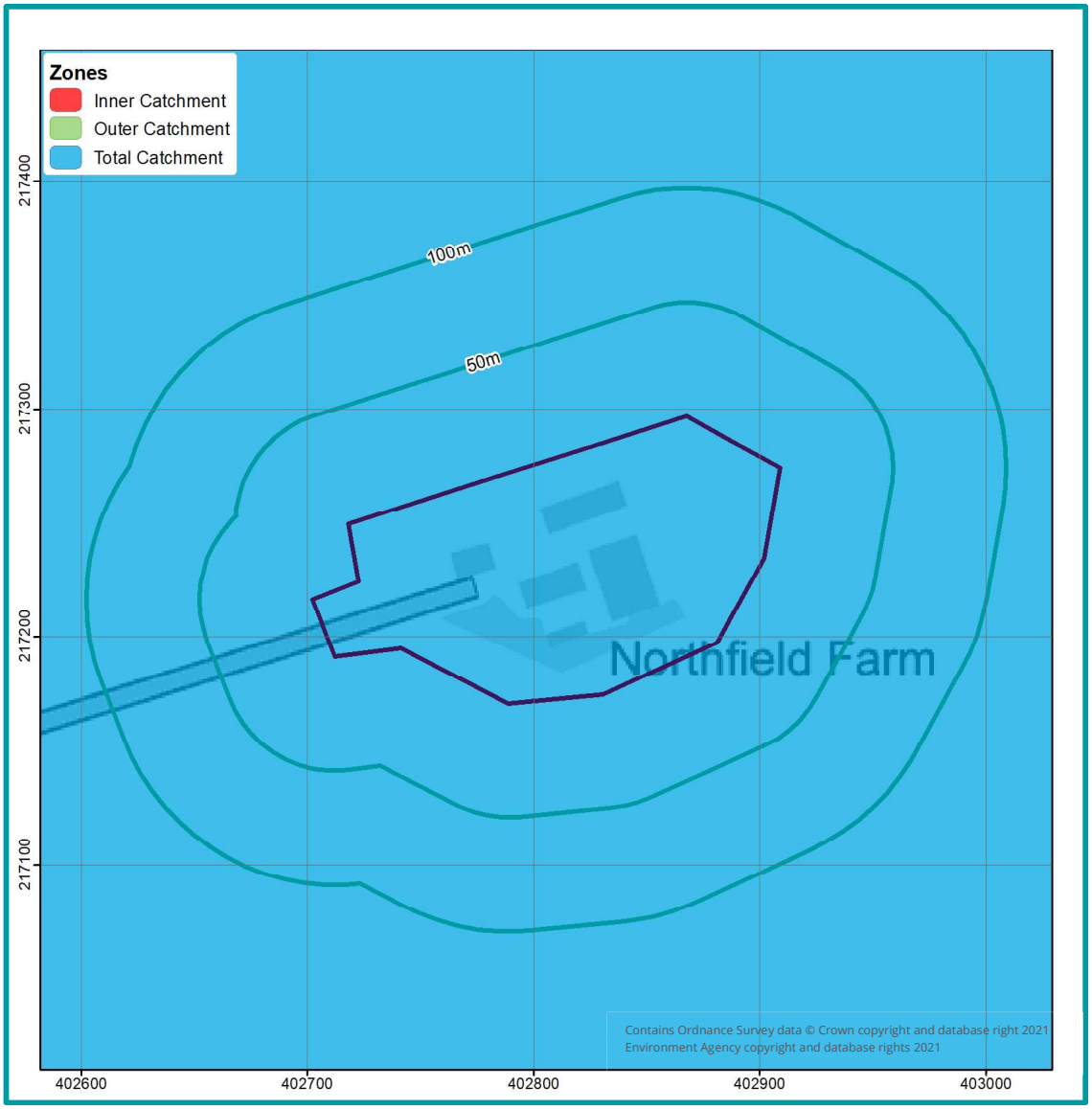
groundwater. Various options can be considered for infiltration SuDS and these include infiltration trenches, soakaways, swales and permeable pavements.

Figure 4. Site topography (GeoSmart, 2021)



An assessment of the topography at the Site has been undertaken using LiDAR DTM5 elevation data to identify the general slope and any localised depressions. The mapping shows a comparison between average ground levels on the Site with ground levels in the surrounding area. The mapping confirms the overall Site is on a gradual slope.

Figure 5. Source protection zone map (EA, 2021)

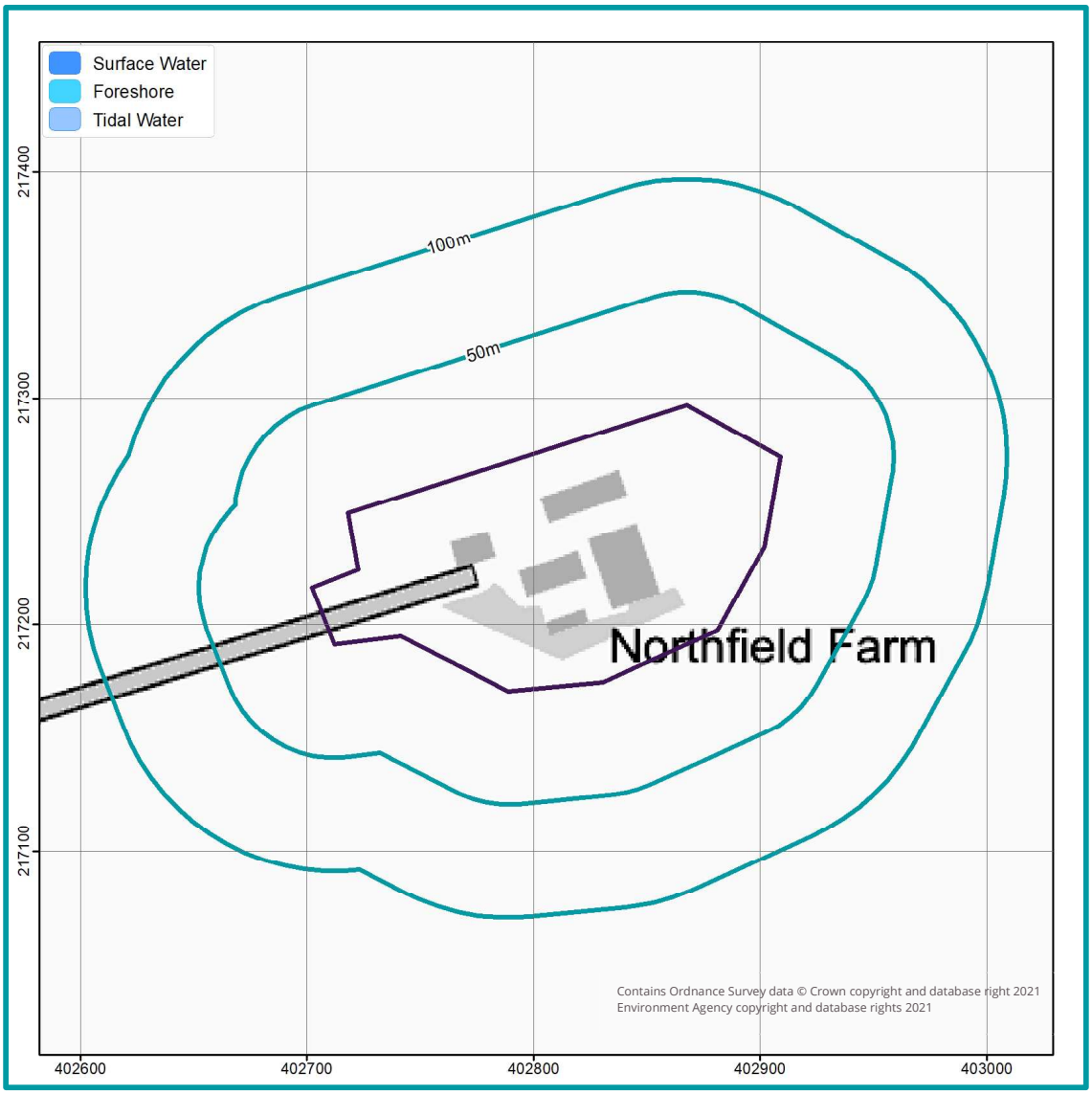


An assessment of the EA's groundwater Source Protection Zones (SPZs) has been undertaken within the vicinity of the Site and confirms the Site lies within a total groundwater Source Protection Zone (SPZ III).

Infiltration, if possible, is likely to be acceptable providing risk screening identifies suitable mitigation measures to prevent an impact on water quality from the proposed or historical land use and contaminated land.

If further analysis is required, this would involve a review of Site specific contaminated land data. If hazards are identified, it is recommended that the Local Authority and the Environment Agency are contacted to confirm the susceptibility of the SPZ and any other SPZs within the wider area.

Figure 6. Surface water features map (EA, 2021)



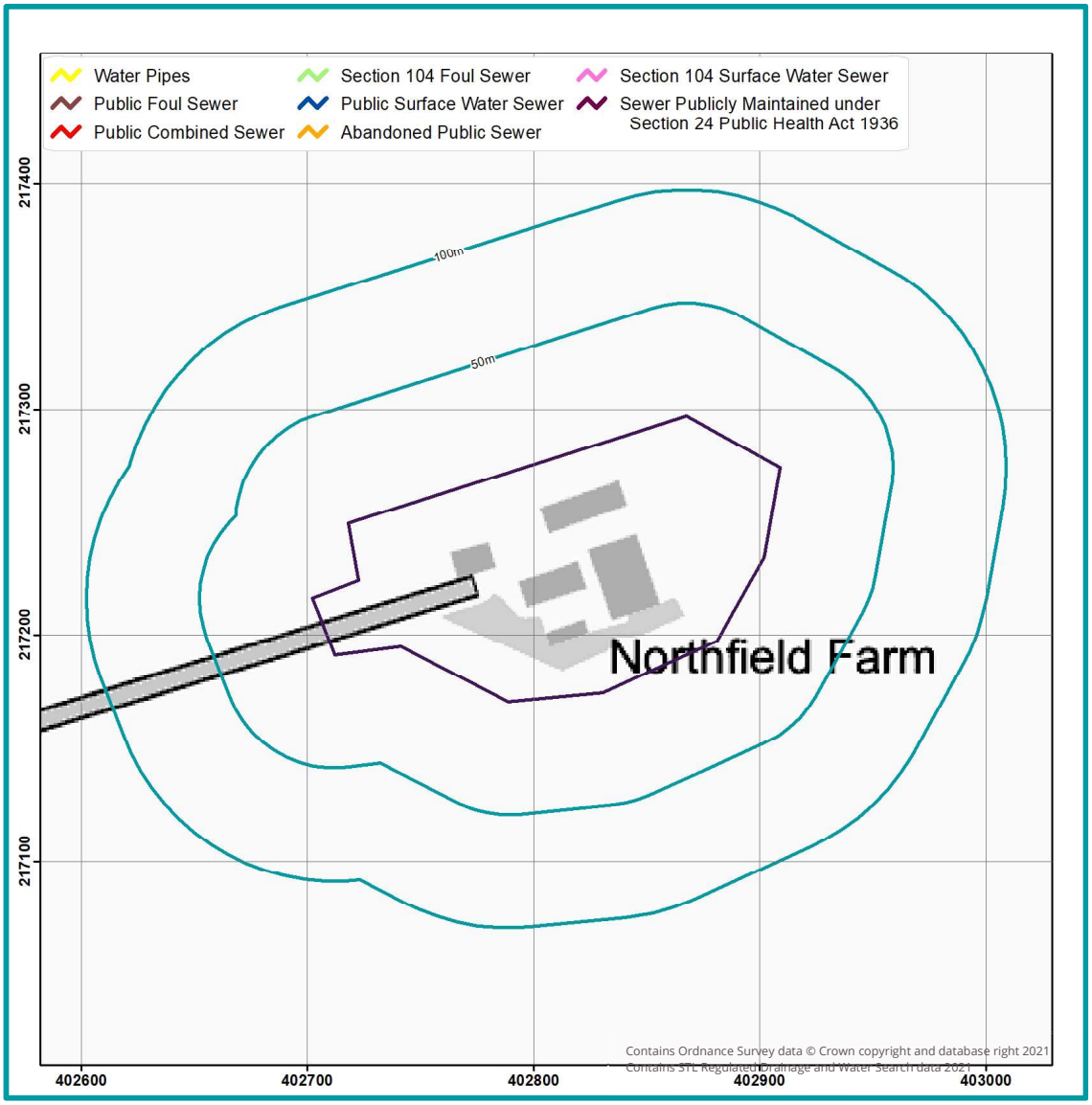
OS mapping indicates there is no surface water feature within 100 m of the Site. As such discharge to a surface water feature would require significant drainage pipework and is therefore considered unfeasible.

According to the topographic survey undertaken at the Site a pond is located on-site however this is to be in-filled during the development.

According to the EA's Magic Map, the Site is not within 250m of a SSSI or SPA.

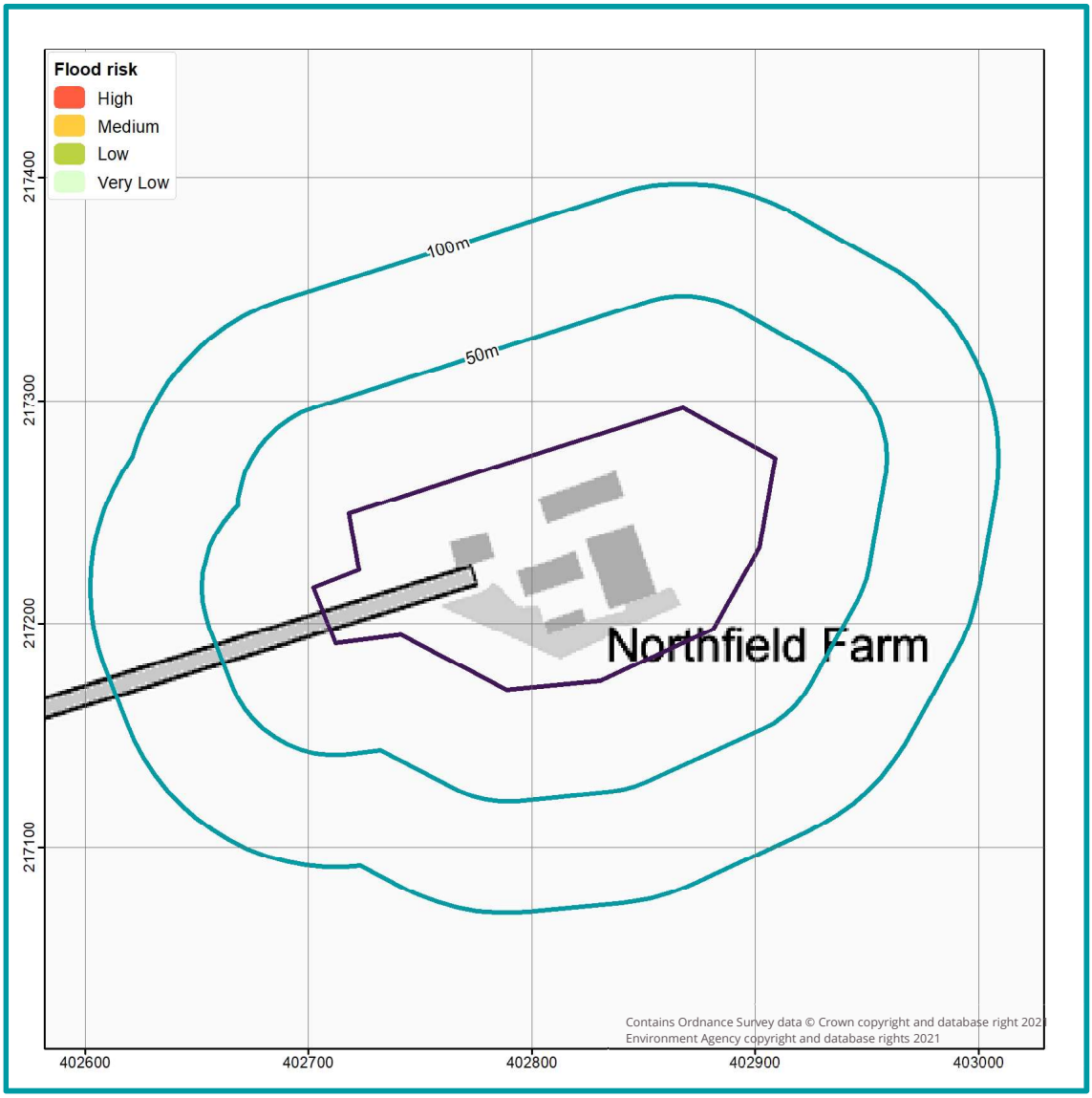
Further analysis could be undertaken by visiting the Site or by contacting the Local Council and the Environment Agency (EA) to confirm the presence, location and condition of any mapped or additional unmapped surface water features.

Figure 7. Sewer features map (OS & STL, 2021)



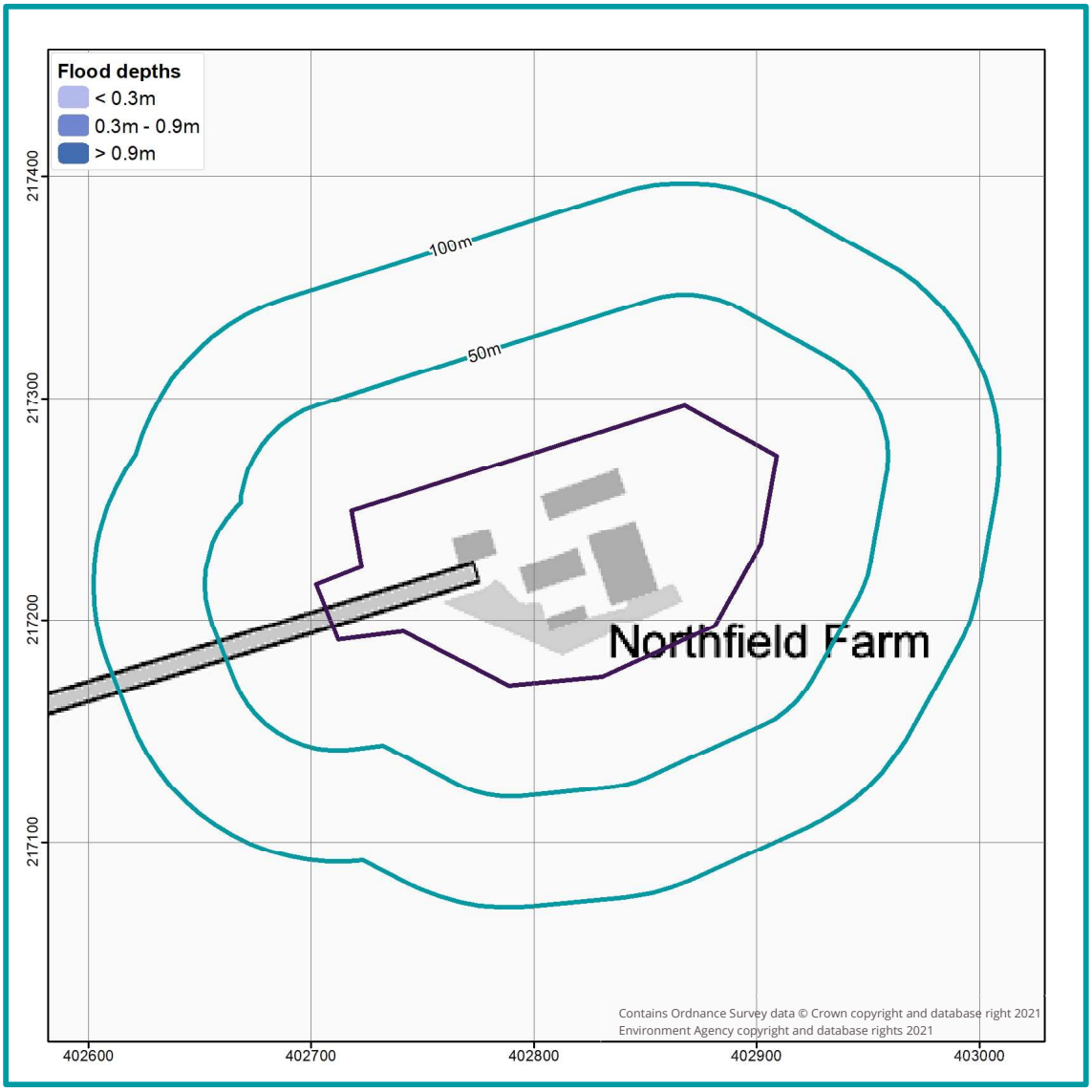
GeoSmart has undertaken an assessment of the location of sewer features within the vicinity of the Site. According to a regulated drainage and water search undertaken at the Site (Appendix C), there are no public surface water sewer or combined sewers located within the vicinity of the Site.

Figure 8. Risk of flooding from rivers & sea map (EA, 2021)



According to the EA's Risk of Flooding from Rivers and the Sea (RoFRS) map, the Site has a Very Low risk of flooding from fluvial or coastal flooding, with less than 0.1% annual probability of flooding, therefore the SuDs design is unlikely to be affected.

Figure 9. Risk of surface water flooding map (EA,2021)

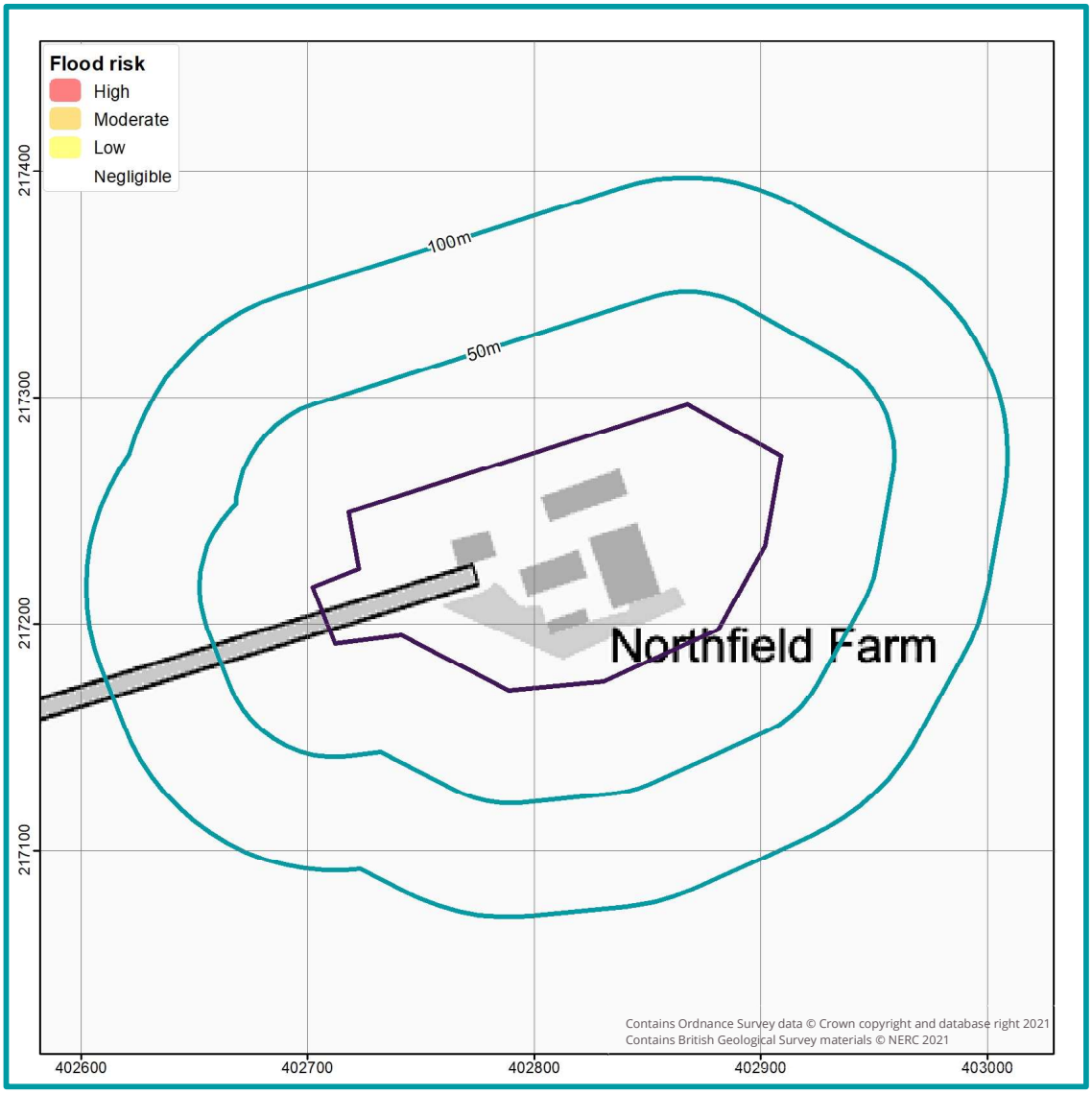


GeoSmart have undertaken an assessment of the risk of flooding from surface water (pluvial) sources within the vicinity of the Site using the EA's Risk of Flooding from Surface Water (RoFSW) mapping. The EA's mapping confirms the Site is considered to be at Very Low risk of surface water flooding.

The above map shows the extent and depth of flooding during a 1% annual probability (1 in 100 year) event, this confirms there are no areas on the Site which would be affected by flooding in the 100 year event.

Further analysis could be undertaken by visiting the Site or by contacting the Local Council and the Environment Agency to confirm the pluvial flood risk, flood depths and velocities where applicable.

Figure 10. Groundwater flood risk (GW5) map (GeoSmart, 2021)



GeoSmart have undertaken an assessment of the risk of flooding from groundwater within the vicinity of the Site. GeoSmart's Groundwater Flood Risk Screening (GW5) map confirms the Site has a Negligible risk of groundwater flooding during a 1% annual probability (1 in 100 year) event.

4 Site context

Site information

The purpose of this report is to assess the potential for disposing of surface water through a Sustainable Drainage System (SuDS) for the site of Northfield Farm, Withington Farm, Andoversford, GL54 4LL (the Site). The Site is located on the outskirts of Andoversford in a setting of agricultural use.

A topographic survey has been undertaken for the Site by Dando Surveying Ltd. (2021) identifying ground levels at the Site fall to the southeast from 178.941 mAOD to 172.40 mAOD. Site plans and drawings are provided in Appendix A.

Development

The Site is currently a disused farm. Development proposals comprise the conversion of 5 barns into residential dwellings.

Geology, permeability and thickness

British Geological Survey (BGS) national superficial and bedrock geology mapping confirms the geological formations underlying the Site and each formation may have a range of permeability.

Table 3. Site Geology

Geology present on-Site		Potentially permeable?
Superficial geology (Figure 11)	No superficial deposits	N/A
Bedrock geology (Figure 12)	Crickley Member- limestone	✓

The permeability of the underlying material at the Site shown within the BGS mapping is high, confirmation of the infiltration capacity is required.

A review of the BGS borehole database (BGS, 2021) indicates there are no relevant boreholes within the vicinity of the Site from which the mapped geology can be inferred.

Figure 11. Superficial Geology (BGS, 2021)

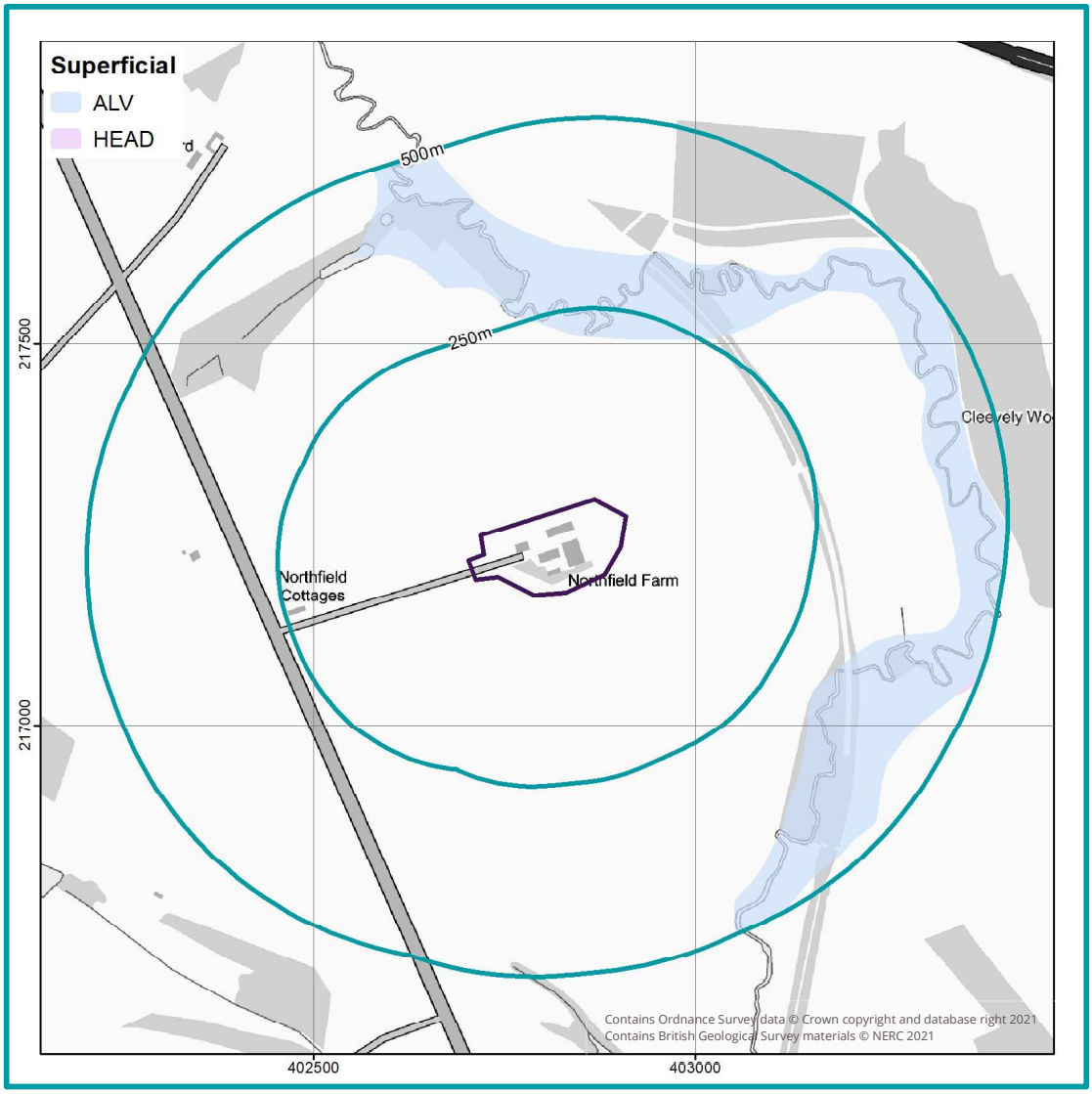
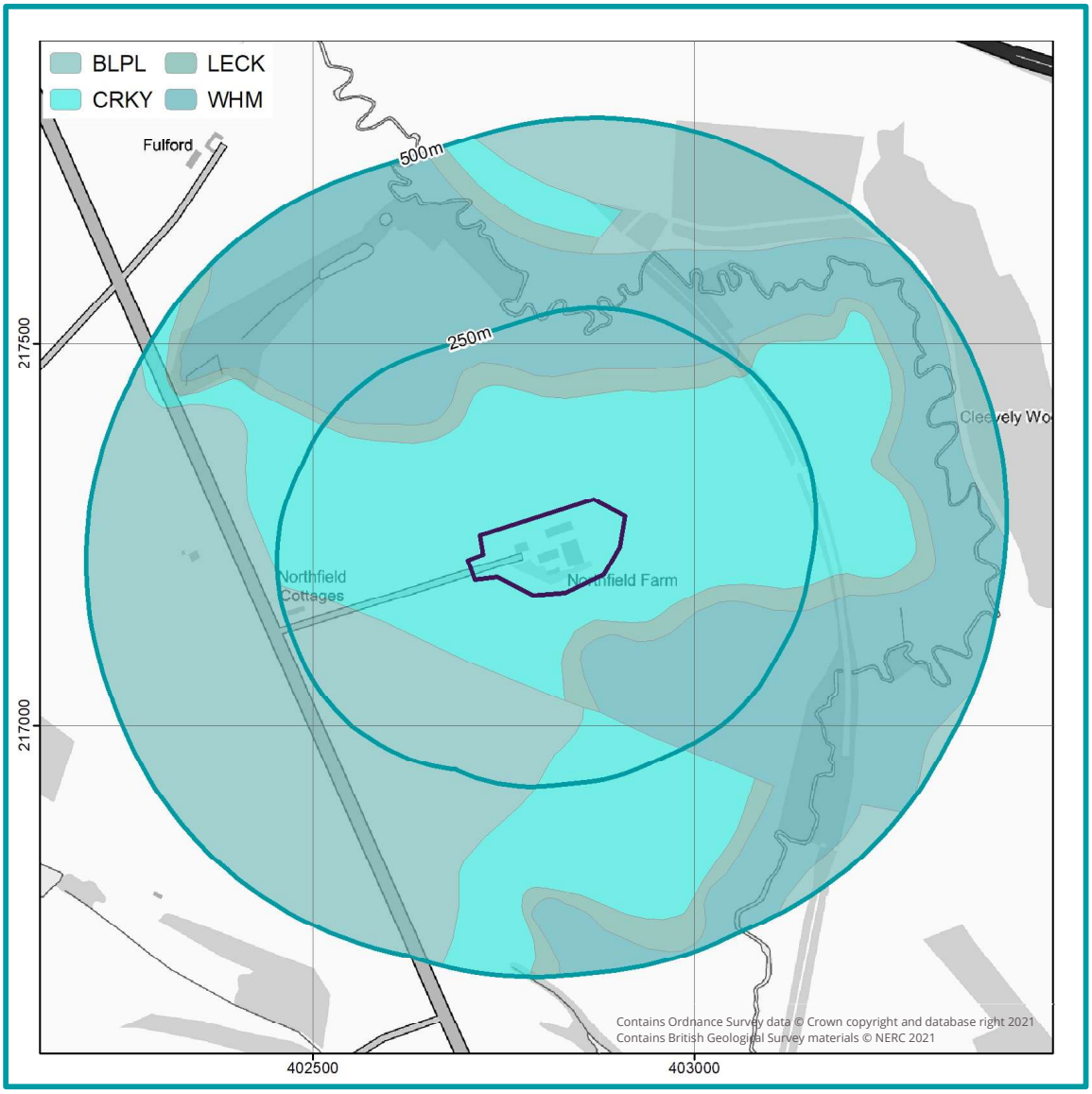


Figure 12. Bedrock Geology (BGS, 2021)



Depth to groundwater

The SuDS system should be designed to operate in periods of extreme groundwater levels.

According to GeoSmart's Groundwater Flood Risk (GW5) map, shallow groundwater is unlikely to be an issue at the Site.

The base of the infiltration system needs to be 1 m above the expected seasonal high-water table. Passage through unsaturated soil is important for improving the quality of infiltrating water before it reaches the water table.

Ground conditions

A Site specific review of underlying ground conditions is recommended to ensure focused infiltration does not cause ground instability as a result of landslide or collapse associated with dissolution or shallow mining. Hazards that should be considered include soluble rocks, landslides, compressible ground, collapsible ground, shrink-swell clays, running sand and shallow mining.

Focused infiltration features should be a minimum of 5m away from the foundations of a building, local guidance may recommend a greater distance A detailed ground assessment is recommended: on steep slopes where infiltrating water would produce saturation and instability downslope; or within layered geology, where infiltrating water would produce springs down gradient.

Water quality

The Site lies within an SPZ, therefore consultation with the Local Authority and assessment of historical land uses should be undertaken to confirm the presence of contaminated material; as this could limit the use of infiltration SuDS.

Infiltration systems should not be used where there is a risk of contaminating groundwater by infiltrating polluted runoff or where receiving groundwater is particularly sensitive.

The influence of surface runoff on water quality will depend on whether there is a source of contamination on-Site and the sensitivity of the receiving environment, either groundwater or surface water. The intervening pathway from source to receptor including mitigation and natural attenuation will determine the final impact.

The impact of contaminants on the groundwater will be reduced by travel and natural attenuation through the unsaturated soil zone. A greater depth of unsaturated zone and the presence of significant clay and organic material will provide greater protection for the underlying groundwater. Rapid flow through fractures will provide less protection than intergranular flow around soil and rock particles.

5 National & local policy context

National Guidance

CIRIA SuDS Manual (C753) (2015)

A development should utilise sustainable drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1. Use infiltration techniques, such as porous surfaces in non-clay areas,
2. attenuate rainwater in ponds or open water features for gradual release,
3. attenuate rainwater by storing in tanks or sealed water features for gradual release,
4. discharge rainwater direct to a watercourse,
5. discharge rainwater to a surface water sewer / drain,
6. discharge rainwater to the combined sewer.

Defra - Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems (2015)

Peak Flow control

For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

Volume control

Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event. The runoff volume must be discharged at a rate that does not adversely affect flood risk.

The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the Site for a 1 in 30 year rainfall event.

Ministry of Housing, Communities & Local Government – National Planning Practice Guidance: Flood risk assessments: climate change allowances (2014)

The Peak rainfall intensity allowances section provides advice on the increased rainfall effects on river levels and land and urban drainage systems. The anticipated changes in peak rainfall intensity in small catchments (less than 5 km^2) and urban catchments are shown in Table 4.

For large rural catchments use the alternative allowances defined for rivers.

In order to understand the range of impact, both the central and upper end allowances should be assessed.

Table 4. Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

The drainage system should be designed to make sure there is no increase in the rate of runoff discharged from the Site for the upper end allowance.

Where on-Site flooding for the upper end allowance presents a significant flood hazard (for example, depths and velocities of surface water runoff cause a significant danger to people), you will need to take further mitigation measures to protect people and property (for example, raising finished floor levels). As a minimum, there should be no significant flood hazard to people from on-Site flooding for the central allowance.

Local Policy

Cotswold District Council Strategic Flood Risk Assessment (JBA Consulting, 2016).

6.4.2. Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems (SuDS) are management practices which enable surface water to be drained in a more sustainable manner and to endeavour to mimic the local natural drainage.

There are many different SuDS techniques which can be implemented. The effectiveness of a flow management scheme within a single site is heavily limited by site constraints including (but not limited to) topography, geology (soil permeability), and available area. The design, construction and ongoing maintenance regime of such a scheme must be carefully defined, and a clear and comprehensive understanding of the catchment hydrological processes (i.e. nature and capacity of