



ARCUS

FLOOD RISK ASSESSMENT
NINFIELD GREENER GRID PARK

JULY 2021



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1 INTRODUCTION

1.1 Background

Statkraft UK LTD ('the Applicant') is proposing the installation of a Greener Grid Park ('the Development') on greenfield land immediately to the south west of Ninfield substation, approximately 1.5 kilometres (km) to the south east of Ninfield ('the Site') at approximate National Grid Reference E 572217, N 111785.

The Site Layout, including all proposed infrastructure, is shown in Appendix A and further detail is included in the Planning Design and Access Statement and suite of Planning Drawings which are submitted as part of the planning application.

Arcus Consultancy Services Ltd ('Arcus') has been commissioned by the Applicant to undertake a Flood Risk Assessment ('FRA') in relation to the Development.

This FRA is intended to meet the requirements of the:

- Environment Agency ('EA');
- Rother District Council (RDC) Strategic Flood Risk Assessment¹ ('the SFRA');
- East Sussex County Council (ESCC) Preliminary Flood Risk Assessment² ('the PFRA');
- ESCC Local Flood Risk Management Strategy³; and
- Revised National Planning Policy Framework ('NPPF')⁴.

1.2 Site Characteristics

The Site location is shown in Plate 1 and the Site layout shown in Appendix A of this report.

The Site area measures approximately 2.58 hectares (ha) and comprises arable fields, with Ninfield substation immediately northeast of the Site as shown in Plate 1.

The area which will comprise of the proposed Development ('the Development Area') measures approximately 1.7 ha in area and is located in the north of the Site.

The Development will connect to the existing Ninfield substation located on the opposite bank of Watermill Stream through sub surface cable routing of approximately 50 metres (m) ('the Cable Route'), as shown in Appendix A.

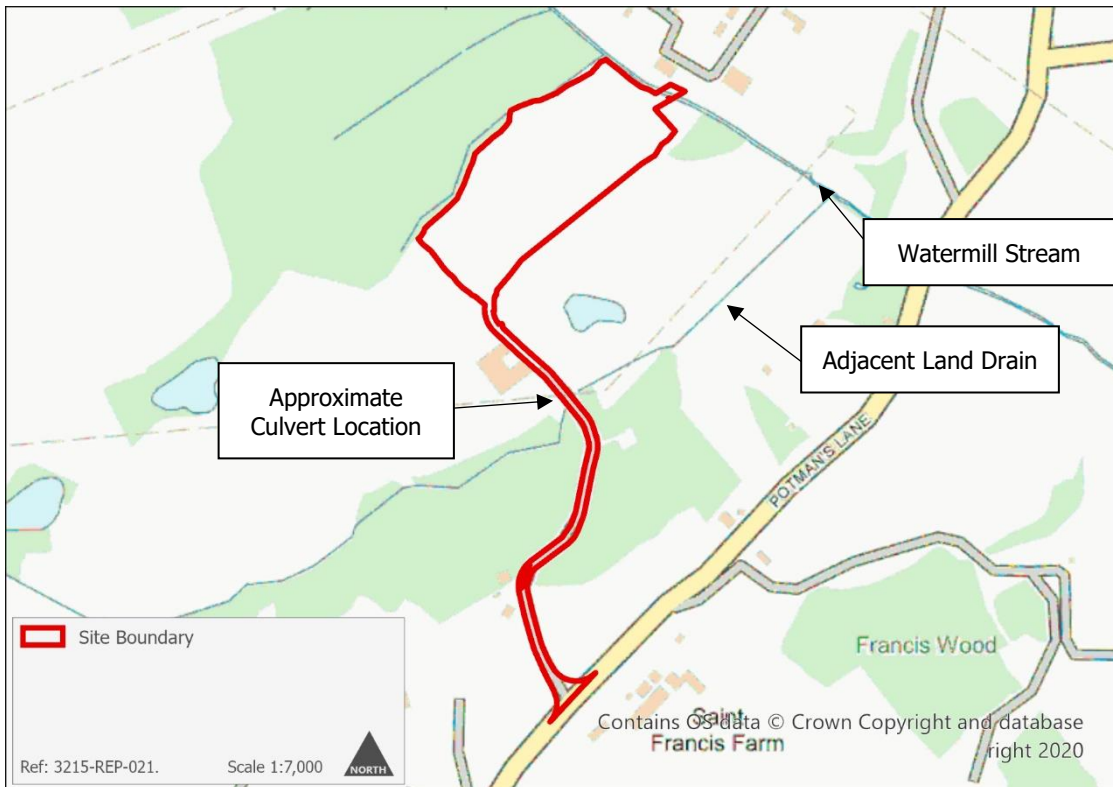
¹ Rother District Council, Strategic Flood Risk Assessment (2008). [Online]. Available at: <https://www.rother.gov.uk/planning-and-building-control/planning-policy/background-evidence/strategic-flood-risk-assessment-sfra/>

² East Sussex District Council, Preliminary Flood Risk Assessment (2011). [Online]. Available at: <https://webarchive.nationalarchives.gov.uk/20140328094441/http://www.environment-agency.gov.uk/research/planning/135538.aspx>

³ East Sussex County Council, Local Flood Risk Management Strategy (2016). [Online]. Available at: <https://www.eastsussex.gov.uk/environment/flooding/localfloodriskmanagementstrategy/>

⁴ Ministry of Housing, Communities & Local Government, Revised National Planning Policy Framework (2019). [Online]. Available at: <https://www.gov.uk/government/collections/revised-national-planning-policy-framework>.

Plate 1: Site Location



1.3 Site Elevations

A topographical survey of the site has been conducted by Ratcliffe Land and Engineering Surveys Ltd in February 2021 and is available in Appendix C. The topographical survey indicates elevations falls west to east from the Site towards Watermill Stream, with elevations ranging from approximately 17 to 31 m Above Ordnance Datum (m AOD).

1.4 Surrounding Hydrological Network

Ordnance Survey (OS) Mapping indicates Watermill Stream is located immediately north east of the Site and becomes a designated Main River immediately downstream of the Site⁵. Watermill Stream flows in an easterly direction to its confluence with Combe Haven approximately 4.4 km south east of the Site.

A land drain is shown to be located 150 m south of the Site and discharges into the Watermill Stream. The watercourse is partly culverted beneath the existing access track, with the culvert location shown in Plate 1.

A pond is located approximately 50 m south of the Site and east of the access track, with maximum depths of approximately 1.2 m and an area of approximately 1,200 m².

The Site is not shown to be located within the operational boundary of an Internal Drainage Board, however the operational boundary extent of the Pevensey and Cuckmere IDB ('the IDB') is located approximately 60 m downstream along Watermill Stream. As such the IDB has been consulted to confirm any requirements in relation to the Development, as shown in Appendix B.

⁵ Environment Agency, Statutory Main Rivers Map. [Online]. Available at: <https://environment.maps.arcgis.com/apps/webappviewer/index.html?id=17cd53dfc524433980cc333726a56386>

1.4.1 Flood Zone Categorisation

The EA Flood Map for Planning shows that the Site is predominantly located in Flood Zone ('FZ') 1, an area described as "low probability" of flooding in Table 1: Flood Zones of the "Planning Practise Guidance to the National Planning Policy Framework"⁶. This zone is categorised as being the lowest flood risk and comprises land assessed as having a less than 1 in 1,000 (0.1 %) annual probability of river or sea flooding in any year.

Areas to the north east of the Site are shown to be located in FZ2 and FZ3 as shown in Appendix C, with such categorisation in relation to Watermill Stream.

The proposed access route is located partly within FZ3; this area currently comprises paved access and therefore will not comprise any additional Development infrastructure.

The Development Area and associated infrastructure is located within FZ1, with the boundary fence of the Development on the FZ3 border, as shown in Appendix D.

The red line boundary for the Site is located within Flood Zone 3 as the Cable Route will run beneath Watermill Stream to the existing Ninfield substation, as shown in Appendix D.

2 FLOOD RISK ASSESSMENT

As the Site is partly located within Flood Zone 3, an FRA has been undertaken in accordance with Paragraph 163 Footnote 50 of the revised NPPF.

2.1 Methodology

Flood risk will be classed as Negligible (where little or no risk is identified), Low (where theoretical risk is modelled but mitigating factors may influence flood levels) or Moderate to High (where modelled levels or historical events show risk to the Development site).

Several factors will be taken into account when attributing the residual risk of flooding to the Development site, including:

- Depth of flooding;
- Flooding extent / ingress into site;
- Type of infrastructure affected; and
- Intervening structures / flood protection.

A residual risk table is provided in the conclusion of this FRA and will provide comment and justification for the risk category using professional judgement and experience assessing similar types of scenarios.

2.2 Fluvial Flood Risk

2.2.1 Watermill Stream

As discussed in Section 1 Watermill Stream is located immediately north east of the Site, with the associated FZ2 and FZ3 categorisations of the Site associated with the watercourse.

The EA Flood Map shows that the Site is primarily located in FZ 1, with areas adjacent to the watercourse located within FZ2 and FZ3. Such areas of the Site will not comprise Development infrastructure, excluding a small part of the boundary fence, as shown in Appendix D.

The EA have been consulted to request modelled flood data for the Site. Such consultation indicates no detailed hydraulic modelling for the Watermill Stream has been conducted on behalf of the EA, with the Flood Map for Planning designation based upon JFlow 1:1,000-

⁶ Environment Agency, Flood Map for Planning. [Online]. Available at <https://flood-map-for-planning.service.gov.uk/confirm-location?eastng=492000&northng=283400&nationalGridReference=SP920834>

year modelled flood data. Such consultation and associated data details are shown in Appendix D.

Whilst JFlow data comprises limitations as a modelling mechanism, as the Development infrastructure is located within FZ1, excluding fencing and the existing access track, the 1:1,000-year JFlow data is a conservative solution to represent the 1:100-year fluvial extents. As the Development infrastructure is located within FZ1, it will be located outside the modelled extents of such events, excluding the aforementioned fencing.

In order to validate the JFlow data provided the EA Risk of Flooding from Surface Water map ('RoFSW') has been consulted. The Lead Local Flood Authority (LLFA) Pevensey and Cuckmere Water Level Management Board have recommended that the 1:1,000-year pluvial event is an appropriate conservative proxy for the 1:100-year fluvial event including climate change allowance⁷.

The RoFSW map indicates that during the 1:1,000-year event no flood waters emanating from Watermill Stream inundate areas which comprise Development infrastructure, as shown in Appendix G.

The Development infrastructure is to be located all within FZ1 excluding one area of fencing and the existing access track, with the flood zone categorisation along the access track not associated with Watermill Stream. Such fencing will not comprise a significant footprint and as such any flood waters at the fencing would not be displaced throughout the Site or elsewhere. Therefore, the proposed Development will not increase flood risk elsewhere in relation to Watermill Stream.

Acknowledging the Development infrastructure being located within FZ1, excluding one area of fencing, the risk of the Development flooding from the Watermill Stream is Negligible.

2.2.2 Drainage Network

As discussed in Section 1.2.1 a land drain is located 150 m south of the Site, which discharges into the Watermill Stream. The existing access track is partly within FZ3 associated with the drain, as shown in Appendix D.

In the absence of modelled data, the EA RoFSW 1:1,000-year event has been used to assess fluvial flooding associated with the drain as a conservative proxy for the 1:100-year climate change fluvial event.

The Development Area is not shown to be impacted by flows deriving from the drain in up to a 1:1,000-year 'low risk' event.

Flows emanating from the land drain are shown to only inundate one area of the Site along the culverted section of the land drain beneath the existing Site access. During the 1:1,000-year event depths at this area are shown to exceed 1.2 m and are limited to the extent of the width of the watercourse.

The 1:1,000-year pluvial event is a conservative representation of the 1:100-year climate change fluvial event and the depths of 1.2 m are therefore an extreme representation of potential flood depths along the existing access track. Acknowledging the conservative approach and limited extent of the flood depths across the existing path, access and egress will not be hindered during such an event.

The existing access will not be altered and not comprise any Development infrastructure; as such the implementation of a suitable drainage network will prevent the flood risk at the Site and elsewhere increasing from the baseline event.

⁷ Email communications between R. Duff (Arcus) and R. Kinsella (Pevensey and Cuckmere Water Level Management Board, LLFA) dated 16th February 2021 to 19th March 2021.

Acknowledging the existing flood risk emanating from the watercourse is limited to a small segment of the existing access track and will not comprise Development infrastructure, the flood risk from the drain to the south is Negligible.

2.3 Pluvial Flood Risk

The Environment Agency defines surface water flooding as follows; *"A surface water flood event that results from rainfall generated overland flow before the runoff enters any watercourse or sewer. Usually associated with high intensity rainfall (typically >30mm/hr) resulting in overland flow and ponding in depressions in the topography, but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen, developed or otherwise has low permeability. Urban underground sewerage/drainage systems and surface watercourses may be completely overwhelmed, preventing drainage. Surface water flooding does not include sewer surcharge in isolation."*

As such, surface water flooding can occur in most places when precipitation events are heavy enough for the local topography and circumstances to be unable to absorb the rainfall.

High rainfall/local groundwater levels leading to the ponding of water in low-lying areas. This type of flooding can often occur seasonally to agricultural land.

The EA Risk of Flooding from Surface Water Map shows that the Development Area is not impacted by pluvial flooding in up to the 1:100-year event, as shown in Appendix F. Areas of the Site are at risk of flooding associated with the surrounding hydrological network as detailed in Section 2.2. Such areas will not comprise Development infrastructure, excluding fencing, and as such will not alter from the baseline scenario.

Acknowledging the lack of pluvial flows within the footprint of any Development infrastructure, excluding fencing, the pluvial flood risk at the Site is Negligible.

2.3.1 Tidal

The Site is located at a minimum elevation of approximately 66 m AOD and 44 km inland of the nearest tidal source and therefore is above the effect of tidal sources.

Therefore, the risk of the Development flooding from tidal sources is Negligible.

2.3.2 Reservoirs

The EA Flood Risk from Reservoirs Map shows that the Site is not located in an area modelled to be at risk of flooding from reservoirs in the event that the retaining walls of the nearest reservoir fail.

Therefore, the risk of the Development flooding from reservoirs is Negligible.

2.3.3 Groundwater Sources

The British Geological Survey (BGS) Borehole Scans show a borehole scan⁸ approximately 80 m east of the Site. This record indicates that grounds near the Site comprise clay and hard marl and shale stratum to depths of 15 m below ground level (bgl). Water was encountered at depths of approximately 1.8 m, but no groundwater rest level was recorded as being present to depths of 15 m bgl.

⁸ British Geological Survey, Borehole Scans. Node: 691292. [Online]. Available at: http://scans.bgs.ac.uk/sobi_scans/boreholes/691292/images/12564298.html

A BGS Borehole log⁹ approximately 75 m north of the Site indicates grounds at the scan comprise clay-based marl stratum to depths of 9.6 m. Groundwater was encountered at depths of 2.7 m.

A BGS Borehole log¹⁰ approximately 75 m north of the Site indicates grounds at the scan comprise clay-based marl and shale stratum to depths of 9.6 m. Groundwater was encountered at depths of 2.4 m, assessed as the highest rest level of groundwater within the vicinity of the Site.

Given the low permeability of bedrock and depth of any resting groundwater flooding as a result of groundwater fluctuations is unlikely and the risk is Negligible.

2.3.4 Flooding from Drainage

The Development is located within a rural area and no highways drainage has been identified.

As such, the risk of the Development flooding from the drainage network is Negligible.

2.4 Flood Risk Along Grid Route

The Grid Route is located within FZ3 upon the embankment of Watermill Stream, as shown in Appendix D.

Works within this area will be temporary and the cables laid underground, which will not affect flood storage volumes or flow conveyance. As such, the risk of flooding and flood displacement from the Grid Route is Negligible.

2.4.1 Works During Times of Flood

Whilst the flood risk related to the Watermill Stream is Negligible, the cable route will likely be within close proximity to the river and as such works during times of flood should be avoided. Directional drilling will be utilised to pass the cable route beneath Watermill Stream.

If there is potential for Watermill Stream to overtop the embankments at which drilling works will take place, personnel and equipment should be evacuated from the Grid Route working area and access should be restricted until the potential for overtopping has passed.

A Flood Incident Plan is provided in Appendix H and should be consulted accordingly during possible times of flood.

3 SURFACE WATER RUN-OFF

The Site is greenfield and appears to be relatively well drained.

The existing access track will be used where possible, limiting the need for new hardstanding. Type 2 aggregate will be used for any new access tracks and will be permeable, as shown in Plate 2.

⁹ British Geological Survey, Borehole Scans. BGS ID: 691288 [Online]. Available at: http://scans.bgs.ac.uk/sobi_scans/boreholes/691288/images/12564294.html

¹⁰ British Geological Survey, Borehole Scans. BGS ID: 391291. [Online]. Available at: http://scans.bgs.ac.uk/sobi_scans/boreholes/691291/images/12564297.html

Plate 2: Typical Type 2 Aggregate



The onsite pluvial characteristics will be further detailed in the Drainage Impact Assessment¹¹ and associated Surface Water Drainage Layout.

4 FOUL DRAINAGE

Welfare facilities including a toilet will be provided for the duration of the operation of the Development. Given the absence of a sewer network onsite, sewage waste will be collected in a temporary septic tank, managed on site and will be taken by a road-going tanker off site by a licensed approved waste contractor.

5 CONCLUSION

This report has been written to meet the requirements of the NPPF and the EA.

The Development is located in Flood Zone 1, an area described as “low probability” of flooding.

The wider Site is located within Flood Zone 2 and 3, with such areas not comprising Development infrastructure, excluding a small area of perimeter fencing.

Table 1 shows that the residual risk of the Development flooding from all sources is Negligible to Low.

¹¹ Arcus Consultancy Services Ltd, Drainage Impact Assessment, Ninfield Greener Grid Park (2021).

Table 1: Risk of Development Flooding

Flooding Source	Potential Risk	Comment	Residual Risk
Fluvial (River)	Negligible	The entirety of the Development is in Flood Zone 1, excluding one area of perimeter fencing located within Flood Zone 2 and 3.	Negligible
Pluvial (Surface Water)	Negligible	The Development Area is not shown to be at any significant risk of pluvial flooding, with one area along the existing access track associated with culverting of the adjacent land drain. No areas which will comprise of implemented Development infrastructure are shown to be at risk of pluvial flooding in up to the 1:100-year event.	Negligible
Tidal	Negligible	The Development site is located at a minimum elevation of 66 m AOD approximately 44 km from the nearest tidal source and therefore onsite drains are not influenced by tidal sources.	Negligible
Reservoirs	Negligible	Not modelled to flood should the retaining wall of the nearest reservoir fail.	Negligible
Groundwater	Negligible	The limited permeability of onsite geology will make any upsurge of groundwater onto the Site unlikely.	Negligible
Flooding from drainage	Negligible	Development located in rural area with no highway's drains identified.	Negligible

APPENDIX A – SITE LAYOUT

APPENDIX B – PEVENSEY AND CUCKMERE IDB CONSULTATION

APPENDIX C – TOPOGRAPHICAL SURVEY

APPENDIX D – FLOOD ZONE CATEGORISATION

APPENDIX E – ENVIRONMENT AGENCY CONSULTATIONS AND DATA

APPENDIX F – 1:100-YEAR PLUVIAL EVENT FLOOD MAP

APPENDIX G – 1:1,000-YEAR PLUVIAL EVENT FLOOD MAP

APPENDIX H – FLOOD INCIDENT PLAN

Responsibility:

A nominated person from site operator will coordinate and implement the evacuation of the launch pad area of direct drilling ('the Development').

The site operator should ensure that all staff for the Development are aware of the evacuation plan and the responsibility for its implementation.

An emergency contact number for the site operator will be made available to all Site personnel. The nominated person from site operator will be available via telephone and the number will be clearly displayed in the substation.

The draft plan is presented in the following table:

Flood Warning Code	Meaning	Action
Flood Watch: 1:30 year	Flooding possible. Be aware. Be prepared. Watch out.	Monitor water levels – Sign up to EA's Floodline Tune into local radio Ring the EA or any flood numbers issued by Council Prepare Emergency Room (offsite). Go through resources required
Flood Warning: Greater than 1:30	Flooding expected Affecting Site. Act now.	As flood watch, plus: Maintain liaison with any local flood defence teams and stay tuned to local radio Prepare to safely shut down, remove fuels / oils / machinery from floodplain and evacuate Site personnel
Severe Flood Warning: 1:100 or greater	Severe flooding expected. Imminent danger to life and property. Act now.	As Flood Warning, plus: Safely shut down and isolate power supplies Prepare for complete site evacuation. Isolate power supplies Evacuate all Site personnel and remove machinery from floodplain
All Clear	An all clear will be issued when flood watches or warnings are no longer in force. Flood water levels receding. Check all is safe to return. Seek advice.	Check with EA and Council that it is safe to return Check with utilities suppliers that they are operational Restore site power supply See that site is properly drained, start-up pumps to drain site (if required) Notify Site personnel. Safely start-up power