The Sizewell C Project

5.2 Main Development Site Flood Risk Assessment Appendices 1-7 Part 14 of 14

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Planning Act 2008
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APPENDIX 5 - UKCP REPORT

CONTENTS

TABLES

PLATES

1 INTRODUCTION

1.1.1. The purpose of this report is to review recently published UK Climate Projections 2018 (UKCP18), compared with currently adopted allowances, and recommend the climate change parameters to be used for the modelling scenarios as part of the Flood Risk Assessment (FRA) work for the proposed Sizewell C development.

1.1.2. The report primarily covers climate change allowances related to the FRA, required as part of the planning process. Whilst it may also be informative to the nuclear safety case, it does not make any explicit recommendations for that study. Concurrently, EDF R&D are preparing a response document on UKCP18.

1.1.3. This report considers climate change associated with coastal flood risk, i.e. relative sea-level rise, storm surge, wind and waves, as well as pluvial and fluvial flood risk, i.e. rainfall intensity and river flows.

1.1.4. The initially adopted climate change allowances (as at 2016) are summarised in Section 2, followed by updates from UKCP18 in Section 3. Section 4 indicates changes in extreme still water levels available from the updated UK Coastal Flood Boundary Dataset (Ref. 21). Section 5 provides recommendations for climate change allowances to be applied in the Sizewell C FRA study.

1.1.5. The initial technical note was issued to EDF and Environment Agency in March 2019. Following the review, provided comments were addressed and appropriate changes were made to the assessment including further details and clarifications in this report.

2 INITIALLY ADOPTED CLIMATE CHANGE ALLOWANCES

2.1 Background

2.1.1. This section provides summary of climate change allowances for assessment of pluvial, fluvial and coastal flood risk at Sizewell C derived in previous analyses in 2015 and 2016. These were based on latest available guidance at the time and discussed with EDF and the Environment Agency.

2.1.2. In the previous climate change assessment, climate change allowances were presented for proposed timings of each development phase of Sizewell C. These timings were agreed at an FRA meeting held on 21st May 2015 between EDF and the Environment Agency and are as follows:

- 2017: start of construction;
- 2025: end of construction & start of commissioning (used for assessment of construction phase flood risk);
- 2085: end of operation (60 years predicted operational lifetime);
- 2110: end of decommissioning;
- 2140: interim spent fuel store decommissioned; and
- 2185: theoretical maximum site lifetime (160 years).

2.1.3. As discussed in later sections of this note, these dates have since been adjusted to account for later start of construction due to changes in overall programme.

2.2 Rainfall Intensity and River Flows

2.2.1. Initial assessment of climate change allowances for rainfall intensity and river flows was carried out in 2015 in line with the National Planning Policy Framework (NPPF) (Ref. 1) and associated guidance, namely the Environment Agency climate change guidance (Ref. 2, now superseded) and a specific study for changes in pluvial events in the Sizewell area from the Met Office, which was commissioned by EDF (Ref. 3).

2.2.2. Following this assessment, a technical note on 'Recommended Climate Change allowances; Fluvial, Pluvial and Groundwater' (Ref. 4) was issued to EDF in early February 2016. In early 2016, the Environment Agency published updated guidance on Climate Change Allowances for Flood Risk Assessments (Ref. 5), further guidance on 'Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities' (Ref. 6) and provided comments on the proposed climate change allowances derived in 2015.

2.2.3. In accordance with the 2016 guidance and comments from the Environment Agency, the approach for dealing with climate change for Sizewell C was updated accordingly as described in the note 'Sizewell C – Flood Risk Assessment Climate Change: Response to reflect 2016 Climate Change guidance' (Ref. 7).

2.2.4. The currently adopted climate change allowances (Ref. 7) for fluvial flood risk are based on the Anglian River Basin District peak river flow allowances for the Higher Central, Upper End Estimates and H++ Scenario with corresponding allowances for each epoch as presented in **Table 2.1**. As recommended in the 2016 guidance, the 2080s changes are used for time epochs beyond 2115.

Table 2.1: Peak River Flow Allowances for Anglian River Basin.

Climate Change Epoch	Higher Central	Upper End (90th percentile)	H++ Scenario
'2020s' (2015-39)	15%	+25%	+25%
'2050s' (2040-2069)	20%	+35%	+40%
'2080s' (2070-2115)	35%	+65%	+80%

2.2.5. The 2016 guidance states for areas greater that 5km^2, the fluvial climate change allowances should be used for peak rainfall intensity. Since the hydraulic model developed for the Sizewell C FRA study applies a direct rainfall to an area greater than 5km^2, peak flow ranges will be applied to account for climate change in peak rainfall intensity.

2.2.6. Further details on the initial climate change assessment and updates following 2016 guidance can be found in the note: 'Sizewell C – Flood Risk Assessment Climate Change: Response to reflect 2016 Climate Change guidance', (Ref. 7).

2.3 Sea Level Rise and Storm Surge

2.3.1. Initial assessments of climate change allowances for sea level rise and storm surge considered multiple sources of information and guidance available at the time, including the following reports and guidance:

- Sizewell C Platform Level and Coastal Flooding: Scoping Report for ALARP Assessment – Atkins, April 2014;
- BECC Scoping Paper: How to Define Credible Maximum Sea Level Change Scenarios for the UK Coast [authored by Professor Robert Wilby] – BECC, January 2014 (Ref. 8);
- Update on Sea Levels for BE Sites using UKCP09 [authored by Robert Nicholls and Derek Clarke] – BEEMS, February 2011;
- Estimation of extreme sea levels at Sizewell. Technical Report TR252 [authored by Kenneth Pye and Simon Blott] – BEEMS, November 2013;
- Update on Estimation of extreme sea levels at Sizewell. Technical Report TR322 – BEEMS, 2014 (Ref. 11);

- Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities (EA, 2011, now superseded by Ref. 6);
- Climate Change Allowances for Planners. Guidance to Support the National Planning Policy Framework (Ref. 2);
- Joint Advice Note: Principles for Flood and Coastal Risk Management (Ref. 9); and
- Late Holocene vertical land motion and relative sea-level changes: lessons from the British Isles. Journal of Quaternary Science, 27, 64-70 – Shennan, I., Milne, G. and Bradley, S., 2012.

2.3.2. Environment Agency guidance recommended using the UKCP09 95 percentile (%ile) estimates of the medium emissions scenarios for reasonably foreseeable climate change and H++ scenario for the credible maximum climate change up to 2110 and beyond.

2.3.3. The initial assessment of climate change allowances for Sizewell C FRA considered the Environment Agency guidance as well as other reports listed above, and a comprehensive study compared rates of change for relative sea level rise and storm surge. Recommended allowances were determined for each epoch, with selected climate change scenarios, as follows:

- the 95%ile of the medium emissions scenario defined by UKCP09 for the reasonably foreseeable sea level rise scenario;
- the upper end of UKCP09 H++ with land motion for up to 2100 and the BECC (2014) upper estimates of sea level rise for beyond 2100;
- no allowance for storm surge for reasonably foreseeable scenario and 1.0m storm surge for epoch beyond 2085 for the credible maximum scenario. The credible maximum estimates of storm surge are at the very top end of the modelled estimates of UKCP09. For the BECC (2014) estimates, surge is already integrated into the values presented.

2.3.4. No surge addition is included to reasonably foreseeable climate change, which is consistent with the advice given in the Environment Agency's 'Adapting to climate change' note (Ref. 6). This note advises "a rigorous analysis of current extreme coastal water levels is undertaken using the national coastal flood boundary dataset for the coasts of England and Wales".

2.3.5. The surge is included within the BECC results. Further details on the analysis of storm surges can be found in BECC report (Ref. 8).

2.3.6. Summary of derived climate change allowances for sea level rise (including applicable storm surge) for key milestone years, relative to 2008 baseline, are presented in **Table 2.2**.

Table 2.2: Climate change scenario changes in sea level (in m) relative to a baseline of 2008.

	UKCP09 / BEEMS (2011)	UKCP09 / BEEMS (2011)	Environment Agency (2011), Shennan et al. (2012)	BECC (2014)	Environment Agency (2011), Shennan et al. (2012)	BECC (2014)
Year	Medium Emissions 95%ile	High Emissions 95%ile	Upper-End Estimate with Land Motion	BECC Lower	H++ with Land Motion	BECC Upper
2017	0.047	0.058	0.043	-	0.061	-
2025	0.093	0.113	0.082	-	0.116	-
2085	0.522	0.637	0.710	-	1.361	-
2110	*0.744*	*0.908*	1.105	1.550	2.206	3.200
2140	*1.014*	*1.238*	-	*1.950*	-	*3.920*
2185	*1.419*	*1.733*	-	*2.400*	-	*4.730*

Note: Italics indicate values that are extrapolated beyond the range stated in guidance (for UKCP09 and BEEMS (2011) values) or interpolated between two bounding values (for BECC (2014) values).

2.3.7. Details on the approach and derived sea level rise and storm surge allowances are set out in Technical Note: Sizewell C Flood Risk Assessment Recommended Climate Change allowances' (Ref. 10).

2.3.8. Wind and Wave Climate

2.3.9. Climate change allowances for 'increased storminess' resulting in higher wind speeds and wave heights adopted in the initial study (Ref. 10) were based on Environment Agency's guidance (Ref. 2). The 2013 guidance suggested assuming a precautionary increase in wave height of 5% up to 2055 and 10% up to 2115 and beyond, although UKCP09 scientific report stated that seasonal mean and extreme waves are generally expected to experience little change in the North Sea.

2.3.10. Due to the significant uncertainties associated with both the future position of the storm track over the UK and the projections of (wind and) wave climate within UKCP09, the currently recommended increases in wave height at Sizewell C for flood risk assessment are 10% for the reasonably foreseeable scenarios and 15% for the credible maximum scenarios with no change in predominant wave direction.

2.3.11. Changes in wave climate associated with sea level rise, as waves propagate across slightly deeper water and therefore break slightly closer to shore were inherently incorporated in the British Energy Estuarine & Marine Studies (BEEMS) modelling studies with suitable sea level rise conditions included in joint probability assessment and wave transformation models.

2.3.12. Further details on the 2015 assessment of potential changes in wave climate are provided in Technical Note: Sizewell C Flood Risk Assessment Recommended Climate Change allowances', (Ref. 10).

3 UKCP18 CLIMATE CHANGE ALLOWANCES UPDATES

3.1 Overview

3.1.1. UK Climate Projections 2018 (UKCP18) provides an updated set of climate projections out to 2100 in the UK and globally, and tools to access climate data designed to help decision-makers assess their risk exposure to climate.

3.1.2. The major innovations in UKCP18 include the use of new observations of weather and climate, inclusion of a more recent generation of climate models from around the world and results from the latest Met Office global and regional climate models used to provide the most up-to date assessment of how the climate of the UK may change over the 21st century and beyond. Further details are available in UKCP18 Science Overview Report (Ref. 12).

3.1.3. In the UKCP18, Representative Concentration Pathways (RCPs) were used, in line with the emissions scenarios specified in the Intergovernmental Panel on Climate Change's 5th assessment report. UKCP09 used the Special Report on Emissions Scenarios (SRES) which were reported on in the IPCC's 4th assessment report.

3.1.4. The emissions scenarios are represented by four radiative forcing levels at the top of the atmosphere by 2100 set to: 2.6, 4.5, 6.0 and 8.5 W/m2. These create four RCPs that are used in UKCP18; namely RCP 2.6, RCP 4.5, RCP 6.0 and RCP 8.5 respectively.

3.1.5. **Table 3.1** presents the global mean temperature increase (best estimate and range between 5% and 95%iles) associated with each RCP and corresponding most similar SRES emissions scenario from UKCP09, as explained in UKCP18 guidance on RCP (Ref. 13).

Table 3.1: The increase in global mean surface temperature averaged over 2081-2100 compared to the pre-industrial period (average between 1850-1900) for the RCPs (best estimate, 5-95% range).

RCP	Increase in global mean surface temperature (°C) by 2081-2100	Most similar SRES scenario (in terms of temperature)
RCP2.6	1.6 (0.9-2.3)	None
RCP4.5	2.4 (1.7-3.2)	SRES B1 (low emissions scenario in UKCP09)
RCP6.0	2.8 (2.0-3.7)	SRES B2 (between the low and medium emission scenarios in UKCP09)
RCP8.5	4.3 (3.2-5.4)	SRES A1F1 (high emissions scenario in UKCP09)

Extracted from UKCP18 Guidance: Representative Concentration Pathways Report (Met Office, 2018)

3.1.6. The updated UKCP18 probabilistic projections over land provide a set of high-resolution spatially-coherent future climate projections for the globe at 60km scale and for the UK at 12km regional scale. Updates to the marine projections give new estimates for sea-level rise and storm surge.

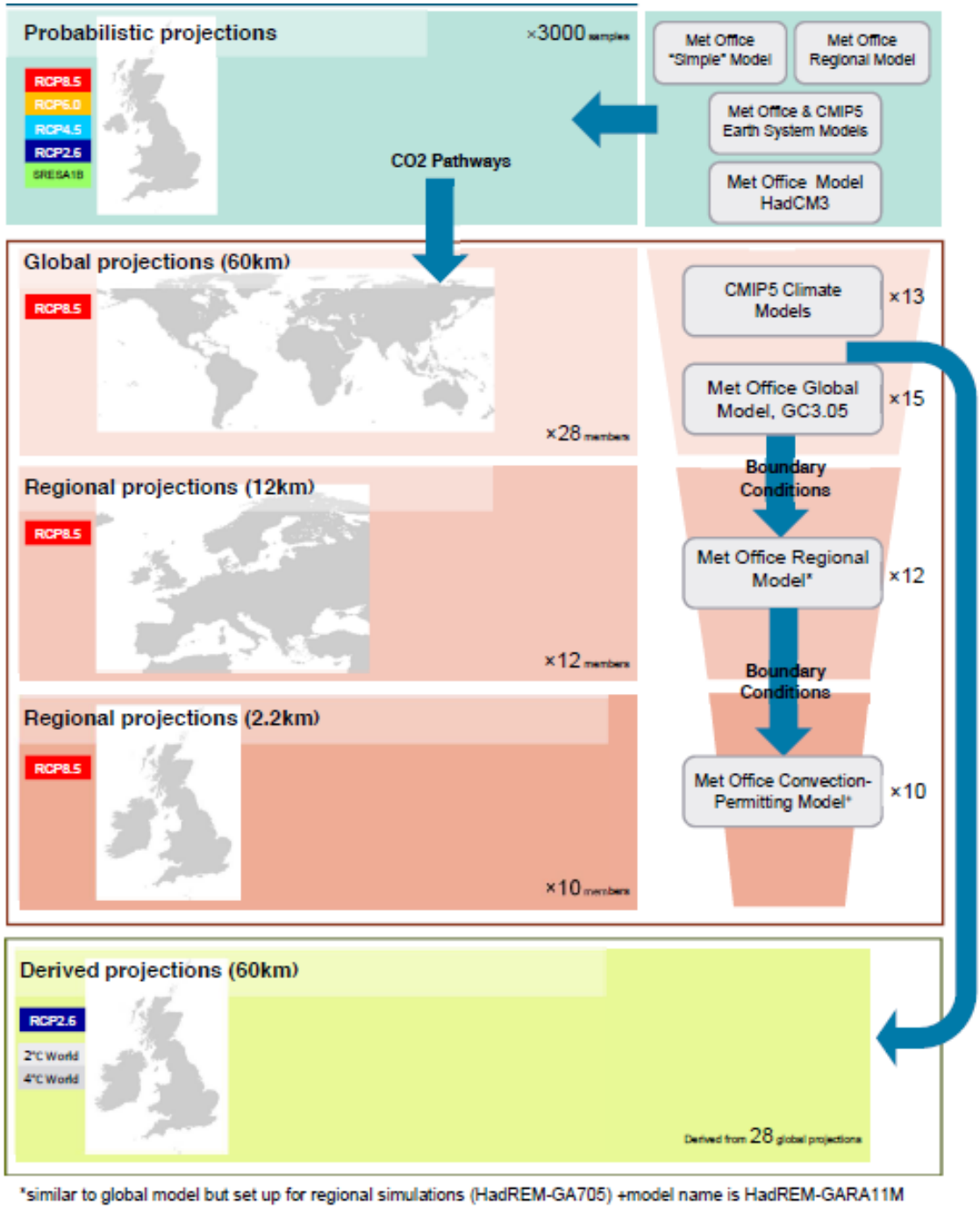
3.1.7. This Section provides summary of land and marine projections relating to the Sizewell C FRA study and comparison with currently adopted climate change allowances.

3.2 Land Projections

3.2.1. UKCP18 Land Projections provide climate features, such as anomalies in humidity, precipitation, sea level pressure, radiation wave flux and air temperature for probabilistic, global, regional and derived projections at different scales. These are explained in the UKCP18 Guidance: How to use the UKCP18 land projections (Ref. 14) and Science Report (Ref. 15).

3.2.2. **Plate 3.1** presents schematic showing how the different land projections components are connected, their scale and what climate models have been used to derive them.

Plate 3.1: Schematic showing how the different components of the land projections are connected (Ref. 14).



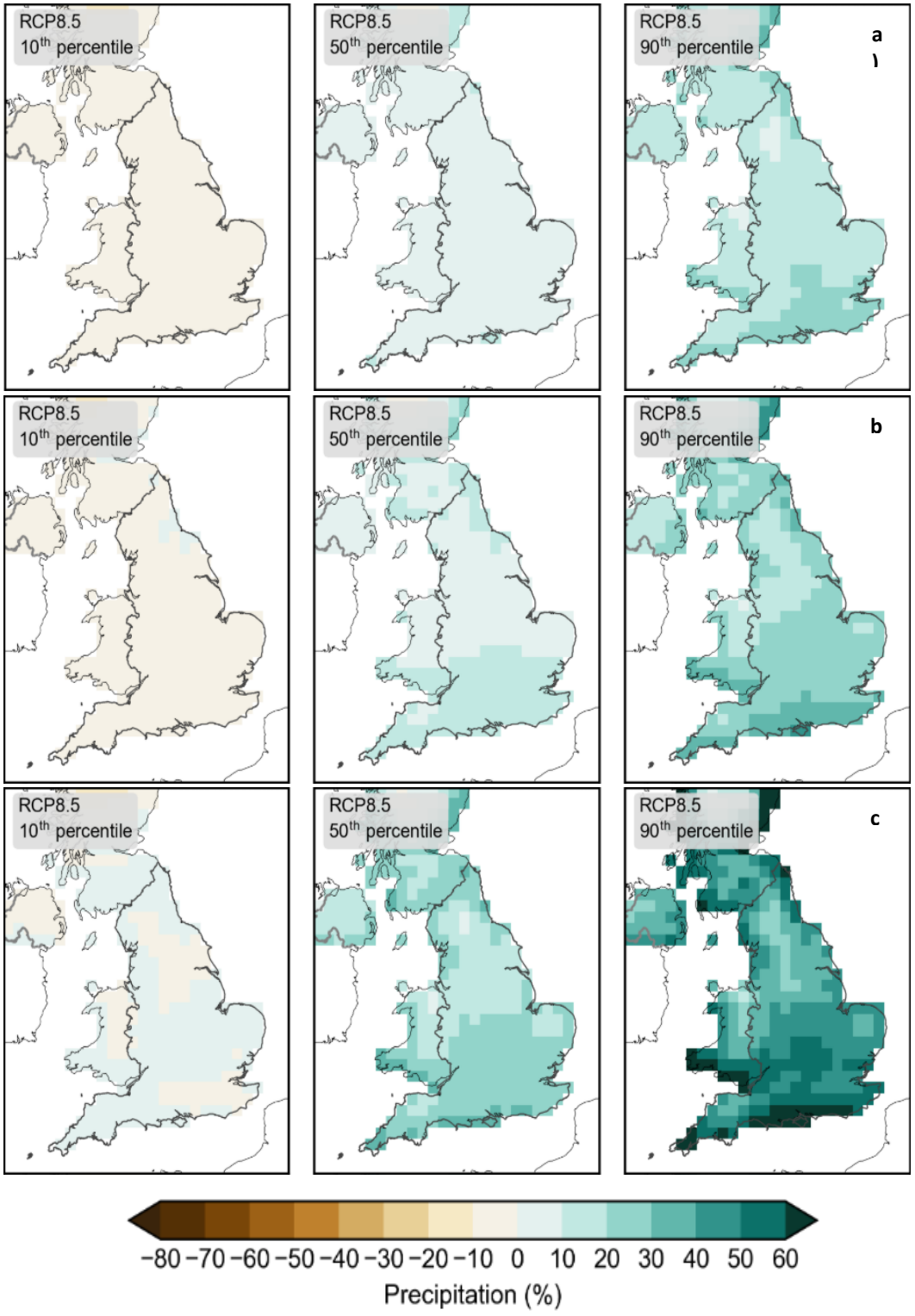
*similar to global model but set up for regional simulations (HadREM-GA705) +model name is HadREM-GARA11M

3.2.3. In terms of climate change allowances used for the Sizewell C FRA study, the UKCP18 land projections provide only changes in rainfall patterns. In summary the UKCP18 states that over land the projected general trends of climate changes in the 21st century are similar to those presented in UKCP09, with a move towards warmer, wetter winters and hotter, drier summers.

3.2.4. Rainfall patterns across the UK are not uniform and vary on seasonal and regional scales and will continue to vary in the future. The projections show a pattern of larger increases in winter precipitation over southern and central England and some coastal regions towards the end of the century. Summer rainfall reductions tend to be largest in the south of England. These key messages refer to total rainfall over a 3-month season and do not infer information about the intensity of individual rainfall events. Further details are available in UKCP18 Factsheet: Precipitation (Ref. 16).

3.2.5. **Plate 3.2** below illustrates changes in rainfall intensity across England for the winter season for three epochs relative to 1981-2000 baseline for the RCP8.5 based on probabilistic projections. The results suggest that for the location of Sizewell C Development (Minsmere River catchment) precipitation for the winter season is predicted to increase by up to 20% for the 2020-2039 epoch, up to 30% for 2040-2059 and up to 50% for the 2080-2099 epoch.

Plate 3.2: Winter Precipitation anomaly for epochs: a) – 2020-2039, b) – 2040-2059 and c) – 2080-2099, relative to 1981-2000 baseline (Ref. 17).



3.2.6. **Table 3.2** presents a comparison of currently adopted climate change allowances for increases in rainfall intensity with estimates provided by UKCP18. The UKCP18 allowances are based on probabilistic projections for RCP8.5 which is most similar to high emissions scenario from UKCP09.

Table 3.2: Comparison of climate change allowances for increase in rainfall intensity.

Climate Change Epoch	Environment Agency Guidance*: Upper End Allowance	Environment Agency Guidance*: H++ Scenario	UKCP18**
'2020s' (2015-39)	+25%	+25%	+10%
'2050s' (2040-2069)	+35%	+40%	+35%***
'2080s' (2070-2115)	+65%	+80%	+50%

**% for increase in rainfall intensity are adopted from allowances for peak river flow for Anglian River Basin, as recommended in the guidance for catchments over, say 5km^2.*
***Precipitation anomaly for winter season across England based on probabilistic projections for RCP8.5.*
****Derived as average % of winter precipitation anomaly in England between 2040-2059 and 2060-2079 time slices (extracted from Met Office Land Projections Maps (Ref. 17).*

3.2.7. UKCP09 provided a Weather Generator which is a tool for providing long synthetic series of daily climate variables. This was used for risk analysis of impacts that depend upon the sequence of weather conditions such as peak river flows. The Weather Generator has not been provided in UKCP18.

3.2.8. The allowances for peak river flow and peak rainfall intensity in 'Flood risk assessments: climate change allowances' (Ref. 5) have not be updated yet to reflect the changes based UKCP18 results. This is because high resolution rainfall projections were only published recently (September 2019) and research is still underway to assess the impact of the rainfall projections in UKCP18 on peak river flow. It is anticipated that Environment Agency would publish updates to these allowances in late 2020.

3.3 Marine Projections

3.3.1. The UKCP18 Marine Projections provide estimates of changes in coastal sea level, including extreme water levels that arise from storm surges and surface waves.

3.3.2. The time-mean sea level projections of UKCP18 are based on updated scientific methods and climate change scenarios compared to UKCP09, that include ice dynamics in projections of future sea level rise, resulting in systematically larger values than presented in UKCP09.

3.3.3. Key findings from the marine projections of UKCP18, as presented in the UKCP18 Marine Report (Ref. 18) are that the RCP climate change scenarios span a greater range of climate forcing over the 21st century than the SRES scenarios used in UKCP09. UK coastal flood risk is expected to increase over the 21st century and beyond under all RCP scenarios, meaning that we can expect to see both an increase in the frequency and magnitude of extreme water levels around the UK coastline.

3.3.4. This increased future flood risk will most likely be dominated by the effects of time-mean sea level rise, rather than changes in atmospheric storminess associated with extreme coastal sea level events. Exploratory time-mean sea level projections to 2300 suggest that UK sea levels will continue to rise over the coming centuries under all RCP climate change scenarios.

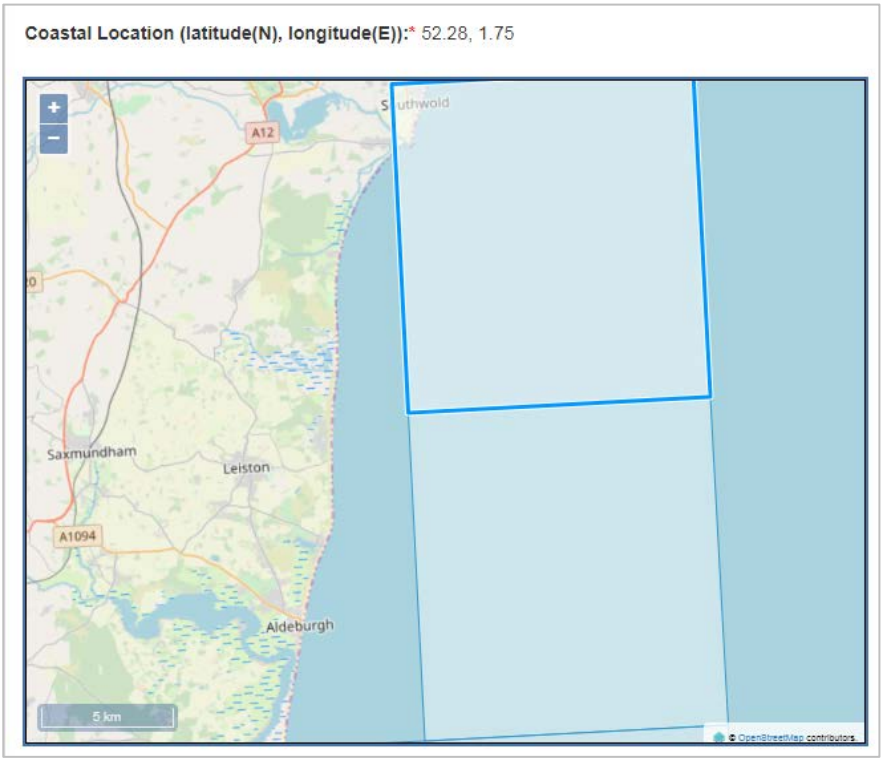
3.3.5. The 21st century projections of average wave height suggest changes up to 10-20% and a general tendency towards lower wave heights. Changes in extreme waves are also of order 10-20%, but there is no agreement in the sign of change among the model projections.

3.3.6. Changes in wave climate over the 21st century on exposed coasts will be dominated by the global response to climate change, and more sheltered coastal regions are likely to remain dominated by local weather variability. The UKCP18 results do not provide any indication on correlation between the extreme sea levels and significant wave height.

3.3.7. The plume of sea level anomalies for marine projections around UK coastline for 21st century projections and extended projections to 2300 were downloaded from the UKCP18 User Interface for the two grid cells closest to the Sizewell C development, as illustrated in **Plate 3.3**.

3.3.8. At the location of the Sizewell C development there are two grid cells that could be used. Initial assessment of the sea rise anomalies showed that grid cell to the north of the Sizewell C (grid square 52.28, 1.75 long/lat highlighted in **Plate 3.3** below) gives slightly higher relative sea rise allowances and was therefore selected for further assessment.

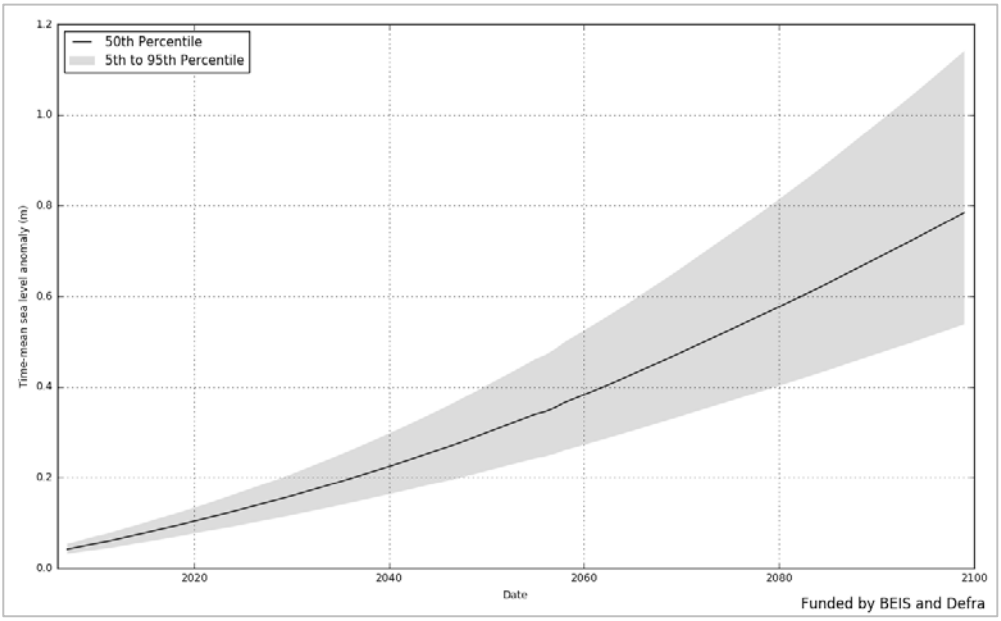
Plate 3.3: Coastal Location of grid cell selected for assessment of UKCP18 Marine Projections for Sea Level Anomalies.



(extracted from UKCP UI Products, https://ukclimateprojections-ui.metoffice.gov.uk/products, accessed on 2nd January 2019).

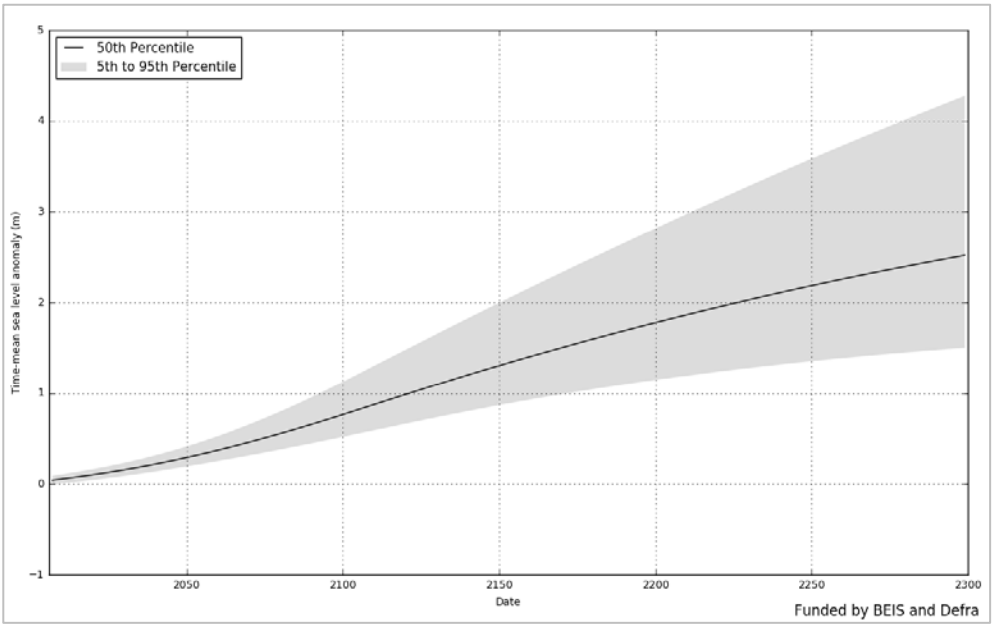
3.3.9. The time-mean sea level anomaly plots for 2007-2100 and 2007-2300 are presented in **Plate 3.4** and **Plate 3.5** respectively. These projections represent relative sea level rise using baseline 1981-2000 and scenario RCP8.5.

Plate 3.4: Time-mean Sea Level Anomaly (m) for 2007 to 2100 for grid square 52.28o, 1.75o, using baseline 1981-2000, and scenario RCP8.5.



(extracted from UKCP UI Products for 'Plume of sea level anomalies for marine projections around UK coastline, 2007-2100', https://ukclimateprojections-ui.metoffice.gov.uk/products, accessed on 2nd January 2019).

Plate 3.5: Time-mean Sea Level Anomaly (m) for 2007 to 2300 for grid square 52.28o, 1.75o, using baseline 1981-2000, and scenario RCP8.5.



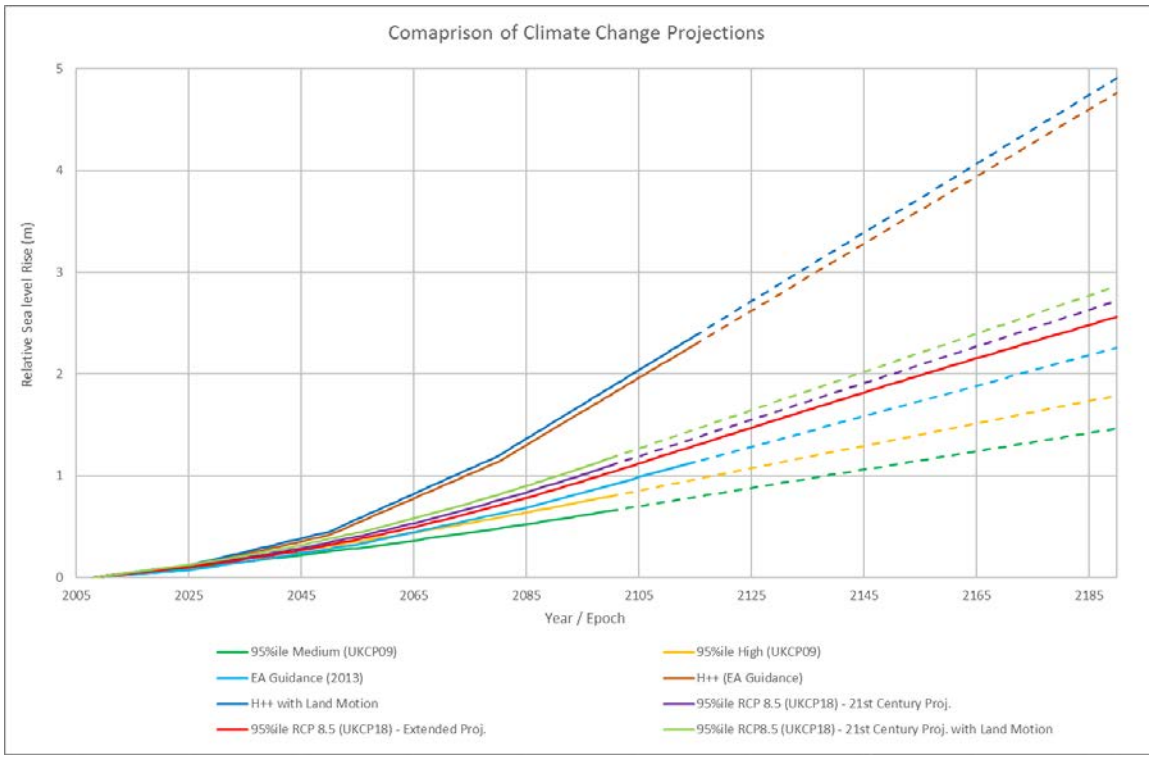
(extracted from UKCP UI Products for 'Plume of sea level anomalies for marine projections around UK coastline using exploratory method, 2007-2300', https://ukclimateprojections-ui.metoffice.gov.uk/products, accessed on 2nd January 2019).

3.3.10. The downloaded time-series of sea level anomalies was used to derive relative sea level rise with baseline of 2008 to compare with the previous assessment (RHDHV, 2015). For this purpose, the 95%ile of RCP8.5 scenario was used, as the most similar to UKCP09 95%ile of high emissions scenario. UKCP18 User Interface does not currently provide marine results for RCP6.0 (between the low and medium emission scenarios in UKCP09).

3.3.11. **Plate 3.6** illustrates the differences between the climate projections of relative sea level rise derived from the previous assessment (Ref. 10) and those derived from UKCP18, with dotted lines indicating values that are extrapolated beyond the range stated in the respective guidance.

3.3.12. The results show that the RCP8.5 scenario of UKCP18 gives higher rates of change in sea level over 21st century than the high emissions scenario from UKCP09, with an increase up to 0.9m for 2185.

Plate 3.6: Comparison of UKCP09, Environment Agency Guidance and UKCP18 Climate Projections for relative sea level rise, with baseline 2008.



3.3.13. The H++ scenario from UKCP09 provided as plausible high-end scenario was not updated as a part of the UKCP18 projections.

3.3.14. **Table 3.3** presents comparison of relative sea level rise at key points in time (in relation to Sizewell C development) derived from the initial assessment (based on UKCP09 and other guidance/studies) and the UKCP18 projections, all relative to baseline 2008. The values for years over 2100 are extrapolated beyond the range provided in the projections and the Environment Agency guidance.

Table 3.3: Relative Sea Level Rise at key points in time derived from initial climate change assessment (UKCP09, Environment Agency Guidance) and UKCP18, grid cell in front of Sizewell C development).

Year	95%ile of Medium Emissions Scenario (UKCP09)	95%ile of High Emissions Scenario (UKCP09)	95%ile RCP8.5 (UKCP18) – 21st century projections*	H++ Scenario with Land Motion and Surge (Environment Agency, 2011)
2025	0.093	0.113	0.110	0.116
2085	0.522	0.637	0.835	1.361
2110	0.744	0.908	1.208	3.206**
2140	1.014	1.238	1.731	4.220**
2185	1.419	1.733	2.561	5.741**

**Note: For epochs beyond 2100 allowances are based on UKCP18 Plume of sea level anomalies for marine projections around UK coastline using exploratory method, 2007-2300 (i.e. extended projections).*

*** Note H++ beyond 2100 includes 1m surge in line with Environment Agency 2011 guidance*

3.3.16. Following completion of this sea level rise allowances comparison in October 2019, in December 2019 the Environment Agency has published updated guidance on climate change allowances for flood risk assessments (Ref. 19). This has updated sea level rise allowances to reflect the latest climate change projections (UKCP18). The most recent sea level rise allowances are based on the UKCP18 RCP8.5 95%ile and 70%iles and provide an average figure for each scenario.

3.3.17. As a part of the UKCP18 Marine Projections, storm surge modelling has been carried out. Storm surges are defined as short-lived increases in local water level above that of the astronomical tide, mostly driven by atmospheric pressure gradients and winds, typically in shallow seas.

3.3.18. The diversity and competition of the processes in the climate system makes projections of the storm track response to climate change less robust than, for example, the global mean temperature response. Therefore, storm

surge model simulations were forced by an ensemble of five climate models.

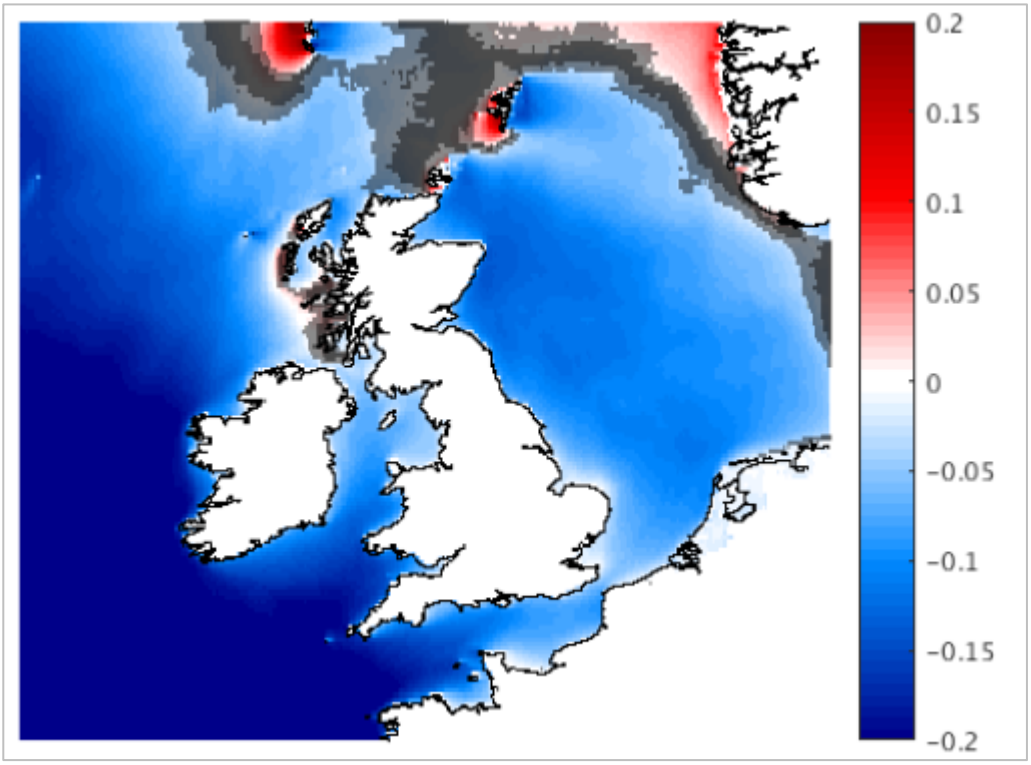
3.3.19. The model results suggest a relatively small contribution from storm surge changes, and it is not yet known whether storm surges will become more severe, less severe or remain the same. Further details are available in the 'UKCP18 Factsheet: Sea level rise and storm surge' Report (Ref. 20).

3.3.20. The UKCP18 also used an ensemble of seven global wave models to explore potential changes in mean and mean annual maximum significant wave height (SWH) under RCP8.5 scenario. Results from these simulations suggest an overall decrease in mean SWH around most of the UK coastline of 10-20% over the 21st century, but the sign of change differs among models and coastal location.

3.3.21. High resolution regional model projections are presented based on a single model under RCP4.5 and RCP8.5 scenarios showing more consistent changes across the 21st century and RCPs for the more exposed coastline, where remote generation of swell waves dominates SWH.

3.3.22. **Plate 3.7** illustrates the change in mean annual maximum significant wave height (absolute change in meters) at the end of 21st century for the RCP8.5 scenario, derived from the regional wave model.

Plate 3.7: Change in Mean Annual Maximum Significant Wave Height from UKCP18 regional wave model, an absolute change, in metres (Ref. 18)



3.3.23. Although projections of changes in wave climate are presented in the overall UKCP18 Science Report and UKCP18 Marine Report, the associated data is not included as a part of UKCP18 deliverables currently available for download. Therefore, it is not possible to investigate wave projections at a local scale relative to the Sizewell C development.

4 EXTREME STILL WATER LEVELS

4.1.1. A number of studies have been carried out to estimate extreme sea levels at Sizewell, including British Energy Estuarine & Marine Studies (BEEMS) that produced Technical Reports TR139, TR252 and TR322 on Sizewell Extremes, HR Wallingford Sizewell Power Station Extreme Sea Level Studies (2010) and EA's UK Coastal Flood Boundary Conditions (Ref. 21).

4.1.2. The latest extreme water levels derived in the BEEMS study and presented in TR322 Report (Ref. 11) were used in the analysis of joint probability of extreme waves and sea levels. They were applied in the wave transformation modelling and subsequently in the analysis of overtopping of sea defences for the Sizewell C coastal flood risk assessment.

4.1.3. Concurrently to the updated UK Climate Projections project (UKCP18), the Environment Agency has updated the UK Coastal Flood Boundary Dataset (UK CFBD) with revised extreme still water levels around the UK coastline, published in 2019 (Ref. 22). Provisional results from this study have been provided in order to assess relative change in the extreme still water levels and advise on potential impacts on the Sizewell C FRA study.

4.1.4. The extreme peak sea levels from the 2011 and the 2018 UK CFBD datasets were extracted for a series of return periods at chainage point 4192, located in the Sizewell C redline boundary as illustrated in **Plate 4.1** below. **Table 4.1** presents the derived extreme still sea levels from both datasets and the differences between them.

4.1.5. The water levels from the 2011 dataset are relative to 2008 base year, whereas levels from 2018 dataset are relative to 2017 base year. The presented extreme water levels do not include confidence intervals.

Plate 4.1: Location of the UK Coastal Flood Boundary Dataset Point in front of Sizewell C development.

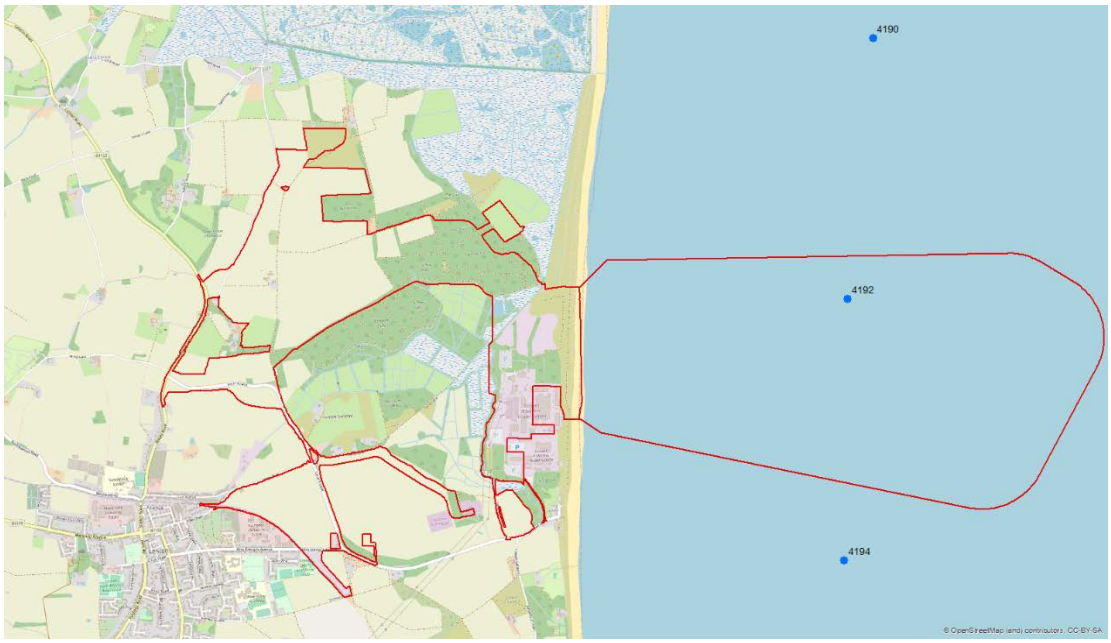


Table 4.1: Extreme Still Water Levels from the 2011 and updated 2018 UK CFBD (Chainage 4192).

Return Period (years)	UK Coastal Flood Boundary Dataset 2011	UK Coastal Flood Boundary Dataset 2018	Difference
T1	1.98	2.00	+0.02
T2	2.12	2.15	+0.03

Return Period (years)	UK Coastal Flood Boundary Dataset 2011	UK Coastal Flood Boundary Dataset 2018	Difference
T5	2.30	2.35	+0.05
T10	2.45	2.51	+0.06
T20	2.60	2.66	+0.06
T25	2.65	2.71	+0.06
T50	2.80	2.84	+0.04
T75	2.90	2.93	+0.03
T100	2.96	2.99	+0.03
T150	3.07	3.07	+0.00
T200	3.13	3.12	-0.01
T250	3.19	3.16	-0.03
T300	3.23	3.20	-0.03
T500	3.36	3.31	-0.05
T1000	3.55	3.44	-0.11
T10000	4.21	3.90	-0.31

4.1.6. The comparison in **Table 4.1** shows the updated extreme still sea levels are slightly higher for events with higher frequency and for events with lower frequency are slightly lower than those derived in 2011.

4.1.7. In order to assess impact of the updated UK CFBD on levels used for Sizewell C FRA, a comparison with the water levels derived in the BEEMS study was carried out, as presented in **Table 4.2**. BEEMS water levels are relative to 2008 base year and CFBD levels are relative to 2017 base year.

Table 4.2: Comparison of Extreme Still Water Levels for Sizewell derived in BEEMS Study (2014) and UK Coastal Flood Boundary Conditions (2018).

Return Period (years)	Water Levels – BEEMS (2014)	UK Coastal Flood Boundary Dataset 2018	Difference
T1	2.23	2.00	-0.23
T2	2.39	2.15	-0.24

Return Period (years)	Water Levels – BEEMS (2014)	UK Coastal Flood Boundary Dataset 2018	Difference
T5	2.61	2.35	-0.26
T10	2.79	2.51	-0.28
T20	2.98	2.66	-0.32
T50	3.24	2.84	-0.40
T100	3.45	2.99	-0.46
T200	3.66	3.12	-0.54
T500	3.96	3.31	-0.65
T1000	4.20	3.44	-0.76
T10000	5.06	3.90	-1.16

4.1.8. **Table 4.2** above suggests that the extreme still water levels derived in the BEEMS study are consistently higher for all return periods and therefore more conservative than those provided in the UK Coastal Flood Boundary Dataset.

4.1.9. As sea levels rise in the future, they could have potential impact on the magnitude and timing of astronomical tides, and thereby influence the tide-surge interaction processes. Such impact of potentially changing tidal patterns has not been considered in the climate change assessment for the Sizewell C study, as normally not required for FRAs.

4.1.10. It is assumed that inherent conservatism in the other adopted climate change allowances and derived extreme water levels is larger than potential effects associated with changes to astronomical tides. However, it is acknowledged that future studies should take into consideration reviews of tidal and surge patterns, including any tidal data that becomes available.

5 RECOMMENDED CLIMATE CHANGE ALLOWANCES

5.1 Overview

5.1.1. The basis for identifying climate change allowances to be used in the Sizewell C FRA are the reasonably foreseeable climate change scenarios that will be applied at different phases of the development. The Nuclear Safety Case will consider events at a greater magnitude than those considered in the FRA applying the credible maximum climate change scenarios.

5.1.2. In this report, currently proposed timings of each phase of the Sizewell C development are assumed as follows:

- 2025: start of construction;
- 2034: end of construction & start of commissioning (2030 used for assessment of construction phase flood risk as sea defences and other key features of the development would be completed by that time);
- 2090: end of operation (60 years predicted operational lifetime);
- 2140: interim spent fuel store decommissioned, stated by EDF; and
- 2190: theoretical maximum site lifetime (160 years in line with EA/ONR Joint Advice Note, Ref. 23).

5.1.3. The original timings, agreed at an FRA meeting with the Environment Agency held on 21st May 2015, were derived based on planned start of construction in 2017. Since 2015 the project was postponed and then re-started in 2018. Therefore, the timings for each phase of the development were adjusted by 5 years to account for the delays in the programme. It is also assumed that hydraulic modelling is not required for all phases of the development, but rather for key points in time.

5.2 Pluvial and Fluvial

5.2.1. The initial assessment recommended using the Upper End and H++ Scenario allowances for both rainfall intensity and peak river flows, in accordance with the Environment Agency guidance (Ref. 5 and Ref. 6). These allowances are based on UKCP09 or research using UKCP09 data undertaken by the Environment Agency.

5.2.2. Following release of UKCP18, it is anticipated that the guidance provided by the Environment Agency would be updated in 2020. Since the updated guidance was not available at the time of this Sizewell C FRA study, it was assumed that for assessing fluvial and pluvial flood risk, currently provided allowances are still valid. In addition, the current guidance suggests that UKCP09 provides useful information on change to rainfall across the UK, which confirms it is most robust for more common events such as changes to the wettest day of a season. Whereas typically, for flood management purposes the concern is rarer events such as those that have a 1 in 20 per year chance of occurring or rarer.

5.2.3. For catchments with areas above 5km^2 the recommendation is to apply the same allowances in rainfall intensity as for peak river flows for the corresponding river basin. On the basis that UKCP18 also provides estimates of change in precipitation for various temporal resolutions rather

than extreme rainfall events, it is recommended for the Sizewell C FRA study to adopt the approach outlined in the Environment Agency 2016 guidance.

5.2.4. **Table 5.1** summarises recommended climate change allowances for rainfall intensity and peak river flows to be applied for all considered return period events in hydraulic modelling, required to assess flood risk for Sizewell C FRA. The reasonably foreseeable scenario would be used for assessment for the FRA, whereas the credible maximum scenario (H++) would be used for sensitivity testing and the Safety Case assessment.

Table 5.1: Recommended Climate Change Allowances to use in Sizewell C FRA for assessment of pluvial and fluvial flood risk.

Development Phase	Year	Climate Change Scenario	Climate Change Allowance
End of Construction / Commissioning	2030	Upper End Allowance	+25%
End of Operation	2090	Higher Central	+35%
Interim Spent Fuel Store Decommissioned	2140	Upper End	+65%
Theoretical Maximum Site Lifetime	2190	H++ Scenario	+80%

5.2.5. For epochs beyond 2115 (2080s) no extrapolation was applied. The 35%, 65% and 80% allowances were used in accordance with the 'Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities' guidance (Ref. 6) stating: '*For changes beyond the 2080s, it is recommended that the 2080s changes are used*'.

5.2.6. **Table 5.2** confirms that key development phases post construction are within the same climate change epochs and will not be run separately. Instead, different allowance will be assessed, i.e. Higher Central and Upper End allowances for reasonably foreseeable scenarios and the H++ as credible maximum scenario.

5.2.7. The hydraulic model developed for the Sizewell C FRA study has a downstream boundary at the Minsmere Tidal Sluice and outfall structure, with the sluice controlling ingress of salt water into the fluvial system.

5.2.8. To account for sea-level rise due to climate change UKCP18 RCP8.5 allowances at 95%ile would be applied to derived tide levels for appropriate epochs in line with the ONR and Environment Agency advice on 'Use of UK Climate Projections 2018 (UKCP18) by GB Nuclear Industry' (Ref. 24).

5.2.9. Following review of the initial of the 'UKCP18 Review and Proposed Response' technical note (issued 13 March 2019) the Environment Agency provided comments and advice on 'How to extrapolate the UKCP18 dataset for sea level rise allowances beyond 2100' (Ref. 25). In accordance with this advice, the UKCP18 21st century projections were extrapolated up to 2125. For allowances beyond 2125, the exploratory projections were used.

5.2.10. Derived cumulative sea level rise allowances (relative to 2017 base year) are recommended to apply to the tide curve for the considered climate change epochs/ key points in time for the Sizewell C development as follows:

- 2030: +0.094m;
- 2090: +0.867m;
- 2140: +1.761m; and
- 2190: +2.591m.

5.3 Coastal – Breach and Inundation

5.3.1. Tidal breach analysis will be carried out to inform a comprehensive assessment of coastal flood risk. These will test both on-site and off-site risk during construction, end of operation and at the end of site lifetime.

5.3.2. It is proposed to use the UKCP18 RCP8.5 at 95%ile allowances for the normal breach and coastal inundation scenarios for all considered epochs. For the scenario with breach of main Sizewell C sea defences, that are designed for 1 in 10,000-year event, it is proposed to use more conservative allowances derived from previous studies, namely the BECC Upper allowance.

5.3.3. It is not proposed to use the more conservative allowances for the breach and inundation of existing shingle coastal defences, as that would lead to higher water levels resulting in quicker and greater inundation of Minsmere and Sizewell Belts. As anticipated and confirmed with preliminary breach modelling, such scenario would show less of an impact of the Sizewell C development on off-site flood risk, whereas the aim of the modelling is to show potential maximum impact of the development.

5.3.4. **Table 5.2** summarises recommended simulation scenarios to be used in the assessment of tidal breach of coastal defences, notably the main sea defence, the shingle ridge near the tank traps and the shingle ridge at Sizewell Gap used for sensitivity testing on breach location. These include suggested flood event frequencies and climate change allowances for sea level rise for the selected epochs for three key development phases; the end of construction (2030), the interim spent fuel store decommissioned (2140) and for the main sea defence and end of site lifetime (2190) for the shingle beach near the tank traps.

Table 5.2: Recommended Scenarios for Tidal Breach Simulations with corresponding Climate Change Allowances, relative to 2017 baseline year.

Year	Climate Change Scenario	Return Period (years)	Sea Defence	Allowance for Sea Level Rise (m)
2030	95%ile of RCP8.5 (UKCP18)	200 1000	Shingle Beach	0.094
2190				1.761
2140	BECC Upper		Main Defence	3.920

**Note: For epoch up to 2125 allowances are based on extrapolated UKCP18 21st century projection. Beyond 2125 allowances are based on UKCP18 Plume of sea level anomalies for marine projections around UK coastline using exploratory method, 2007-2300 (i.e. extended projections).*

5.3.5. As discussed in **Section 3.3**, in December 2019 the Environment Agency has published updated guidance on sea level rise allowances for flood risk assessments based on the UKCP18 results (Ref. 19). This updated guidance was not available at the time of this UKCP18 review or the modelling studies carried out for the Sizewell C project and therefore the UKCP18 allowances for sea level rise were used adopting the RCP8.5 at 95%ile. Since the updated guidance is based on average of RCP8.5 95%ile and 70%iles it is considered that the adopted allowances for the Sizewell C study are slightly more conservative.

5.4 Coastal – Overtopping of Main Sizewell C Sea Defence

5.4.1. Climate change allowances for sea level rise (SLR) and storm surges for modelling of Sizewell C sea defence overtopping derived in the previous assessment (Ref. 10) were based on multiple studies and scenarios, as summarised in **Section 2.3** of this report. From the scenarios considered, only UK Climate Projections have been updated and it is assumed that other guidance and studies are still valid and can be used to inform the Sizewell C FRA, where applicable.

5.4.2. Considering that allowances for sea level rise provided in the updated UKCP18 projections are higher than those derived in the UKCP09, as presented in **Table 3.3** in **Section 3.3**, it is recommended that these higher values are evaluated in the Sizewell C FRA.

5.4.3. Currently available results from UKCP18 do not provide scenario equivalent to 95%ile Medium Emissions scenario from UKCP09 (which was previously agreed as the 'reasonably foreseeable' climate change). In the interim, the more conservative UKCP18 RCP8.5 95%ile will be used as a high 'reasonably foreseeable' scenario. The FRA will discuss the level of conservatism associated with this approach.

5.4.4. As part of the Safety Case and ongoing climate monitoring regime, actual and projected climate change will be reviewed every 10 years (including any updated projections available at the time), to inform decisions on when to raise the defences in front of the main Sizewell C platform and SSSI crossing. This will also feed into periodic updates of the Flood Warning and Evacuation Plan.

5.4.5. The summary interpretation of the recent evidence presented in UKCP18 Science Report (Ref. 12) is that the H++ scenario of UKCP09 should still be considered as plausible high-end sea level pathway. The recommendation is that decision makers make use of the projections from UKCP18 alongside multiple strands of evidence, including H++ scenarios, when assessing vulnerabilities to future extreme water levels.

5.4.6. As stated in **Section 4.1.2**, derived climate change allowances were applied to the baseline water level and used in joint probability analysis to determine extreme sea level and nearshore wave conditions for assessment of overtopping of coastal sea defences. These analyses were carried out by Cefas for EDF, prior to the release of UKCP18.

5.4.7. As discussed in **Section 3.3**, UKCP18 results suggest relatively small contribution from storm surge changes to the extreme water levels. Currently, there is low confidence in predicting whether storm surges will become more severe, less severe or remain the same. The previous assessment (Ref. 10) suggested applying 1m surge to for climate change epochs beyond 2085 for the credible maximum scenarios only, i.e. H++ scenarios. Since UKCP18 does not provide clear guidance on potential changes to storm surge in the future, it is recommended that the approach adopted in the previous assessment is retained. Therefore, no surge is applied to the 'reasonably foreseeable' scenario for RCP8.5.

5.4.8. The previous assessment (Ref. 10) recommended using climate change allowances for increase in significant wave heights based on the Environment Agency guidance (Ref. 2), and not direct results from

UKCP09. Due to the UKCP18 results indicating a general relative reduction in significant wave height, and the lack of clear recommendations or data available to derive appropriate allowances from UKCP18, it is proposed to retain the conservative wave assumptions from the previous assessments; the 10% increase for all epochs for reasonably foreseeable scenarios and 15% for credible maximum scenarios.

5.4.9. Based on the above information, it is recommended to use previously derived climate change allowances for changes in storm surges and significant wave heights.

5.4.10. For the relative sea level rise allowances, the recommendation is to focus on the 95%ile of the RCP8.5 scenario where applicable (in place of 95%ile of High Emissions or Medium Emissions scenarios from UKCP09), and on the H++/BECC Upper scenarios, and where feasible 'match' the allowances to the closest currently available climate change scenarios considered in Cefas joint probability assessment. Wave overtopping modelling will use the updated still water levels and the nearest available wave conditions.

5.4.11. **Table 5.3** presents derived climate change allowances for sea level rise for the key points in time of the Sizewell C development. All values are relative to 2008 base year.

Table 5.3: Derived Climate Change Allowances for selected scenarios and key points in time, relative to 2008 base year.

Development Phase	Year	Relative Sea Level Rise Climate Change Allowance for 95%ile of RCP8.5 (UKCP18)* Scenario (m)	Relative Sea Level Rise Climate Change Allowance for H++/BECC Upper (2014)** Scenario (m)
Start of Construction	2025	0.110	-
End of Construction / Commissioning	2030	**0.148**	-
End of Operation	2090	0.921	-
Interim Spent Fuel Store Decommissioned	2140	**1.815**	**3.920**
Theoretical Maximum Site Lifetime	2190	**2.645**	4.820

*Note **bold** values indicate particular focus scenarios, although additional scenarios may be run to inform the assessments*
** For epoch up to 2125 allowances are based on extrapolated UKCP18 21st century projection. Beyond 2125 allowances are based on UKCP18 Plume of sea level anomalies for marine projections around UK coastline using exploratory method, 2007-2300 (i.e. extended projections).*
*** BECC Upper (2014) estimates have surge component already integrated into the values presented, so no further surge adjustment was applied*

5.4.12. **Table 5.4** summarises recommended key simulation scenarios to be used in assessment of wave overtopping of the main Sizewell C coastal defences of the main sea defence. These include suggested flood event frequencies and climate change allowances for sea level rise (including storm surge where applicable). Additional runs were carried out for the SSSI Crossing considering the same return period events and climate change scenarios.

5.4.13. The timing of end of construction/ commissioning phase has been shifted by 5 years due to project delays. Therefore, previously derived allowance for sea level rise up to 2025 has been updated to reflect additional 5 years of potential change. For that reason, the closest case from the currently available Cefas joint probability assessment has been identified, that will be used to derive nearshore wave conditions for wave overtopping modelling.

5.4.14. The extreme still water levels for the overtopping model will be derived by applying climate change allowances presented in the **Table 5.4** below to the adopted 2008 baseline still water level.

Table 5.4: Recommended Scenarios for Wave Overtopping Simulations with corresponding Climate Change Allowances, relative to 2008 baseline year.

Year	Climate Change Scenario	Return Period (years)	Main Sea Defence Height	Allowance for Sea Level Rise (m)
2030	95%ile of RCP8.5 (UKCP18)	200 1000	5.0mOD and 7.0mOD**	0.148
2140	95%ile of RCP8.5 (UKCP18)*	200 1000 10,000	10.2mOD and 14.2mOD	1.815
	BECC Upper (2014)	1000 10,000	14.2mOD	3.920

Year	Climate Change Scenario	Return Period (years)	Main Sea Defence Height	Allowance for Sea Level Rise (m)
2190	95%ile of RCP8.5 (UKCP18)*	200 1000	10.2mOD and 14.2mOD	2.645

**For epoch up to 2125 allowances are based on extrapolated UKCP18 21st century projection. Beyond 2125 allowances are based on UKCP18 Plume of sea level anomalies for marine projections around UK coastline using exploratory method, 2007-2300 (i.e. extended projections).*
***5.0m assumed most exposed (lowest elevation) of coastal defences during preparation of sea defence foundations, to be confirmed with EDF Engineering team, followed by interim haul road elevation at 7.0m.*

5.4.15. As discussed in **paragraph 5.3.5** in **Section 5.3**, it is acknowledged that the Environment Agency has published updated guidance on sea level rise allowances for flood risk assessments based on the UKCP18 results (Ref. 19). However, as this updated guidance was not available at the time of this UKCP18 review or the modelling studies carried out for the Sizewell C project, for the relevant scenarios the UKCP18 allowances for sea level rise were used adopting the RCP8.5 at 95%ile (slightly more conservative than the latest Environment Agency guidance).

6 REFERENCES

Ref. 1 Ministry of Housing, Communities and Local Government. National Planning Policy Framework. London: The Stationery Office, February 2019

Ref. 2 Environment Agency – Climate Change Allowances for Planners. Guidance to Support the National Planning Policy Framework, September 2013

Ref. 3 Met Office – Extreme Precipitation Analysis at Sizewell: Final Report, 2011

Ref. 4 RHDHV – Sizewell C Flood Risk Assessment Recommended Climate Change allowances; Fluvial, Pluvial and Groundwater (Internal Ref: SZC FRA Climate Change note_fluvial pluvial V4, PB1452/Climate Change/303821/Lds), February 2016

Ref. 5 Environment Agency – Flood Risk Assessments: Climate Change Allowances, February 2016: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#history

Ref. 6 Environment Agency – Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities, April 2016: https://www.gov.uk/government/publications/adapting-to-climate-change-for-risk-management-authorities

Ref. 7 RHDHV – Sizewell C: Flood Risk Assessment Climate Change: Response to reflect 2016 Climate Change guidance (Internal Ref: Sizewell C Climate Change Update, PB1452OD083v02), September 2016.

Ref. 8 BECC – BECC Scoping Paper: How to Define Credible Maximum Sea Level Change Scenarios for the UK Coast, January 2014.

Ref. 9 Office for Nuclear Regulation and Environment Agency – Joint Advice Note: Principles for Flood and Coastal Risk Management, Version_3, April 2013

Ref. 10 RHDHV – Sizewell C Flood Risk Assessment Recommended Climate Change allowances (Internal Ref: SZC FRA TO1 Climate Change note (v5-1) (final), PB1452/TO1 Climate Change/303958/Pbor), September 2015.

Ref. 21 BEEMS – Technical Report TR322: Update on Estimation of extreme sea levels at Sizewell, 2014

Ref. 12 Met Office – UKCP18 Science Overview Report, November 2018: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf

Ref. 13 Met Office – UKCP18 Guidance: Representative Concentration Pathways, 2018: https://www.metoffice.gov.uk/binaries/content/assets/mohippo/pdf/ukcp18/ukcp18-guidance-rcp.pdf

Ref. 14 Met Office – UKCP18 Guidance: How to use the UKCP18 land projections, 2018: https://www.metoffice.gov.uk/binaries/content/assets/mohippo/pdf/ukcp18/ukcp18-guidance-how-to-use-the-land-projections.pdf

Ref. 15 Met Office – UKCP18 Land Projections: Science Report, November 2018: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Land-report.pdf

Ref. 16 Met Office – UKCP18 Factsheet: Precipitation, 2018: https://www.metoffice.gov.uk/binaries/content/assets/mohippo/pdf/ukcp18/ukcp18-factsheet-precipitation.pdf

Ref. 17 Met Office, Land Projections Maps: Probabilistic Projections – https://www.metoffice.gov.uk/research/collaboration/ukcp/land-projection-maps (accessed on 19th February 2019)

Ref. 18 Met Office – UKCP18 Marine Report, November 2018: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Marine-report.pdf

Ref. 19 Environment Agency – Flood Risk Assessments: Climate Change Allowances, December 2019: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Ref. 20 Met Office – UKCP18 Factsheet: Sea level rise and storm surge, 2018: https://www.metoffice.gov.uk/binaries/content/assets/mohippo/pdf/ukcp18/ukcp18-factsheet-sea-level-rise-and-storm-surge.pdf

Ref. 21 Environment Agency – UK Coastal Flood Boundary Conditions (Project SC060064/TR4: Practical Guidance Design Sea Levels), 2011

Ref. 22 Environment Agency – Coastal Flood Boundary Conditions for UK: Update 2018 (Project: SC060064/TR6: Technical Summary Report), May 2019

Ref. 23 Office for Nuclear Regulation and Environment Agency – Joint Advice Note: Principles for Flood and Coastal Risk Management, Version 1, July 2017

Ref. 24 Office for Nuclear Regulation and Environment Agency – Use of UK Climate Projections 2018 (UKCP18) by GB Nuclear Industry, March 2019

Ref. 25 Environment Agency – Reply to UKCP18 Report (AE/2015/119103/02) addressed to [redacted] (On behalf of Sizewell C Co), 20 May 2019

APPENDIX 6 - SIZEWELL B RELOCATED FACILITIES FLOOD RISK ASSESSMENT

VOLUME II:
TECHNICAL APPENDICES

14.1 Flood Risk Assessment

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CONTENTS

TABLES

FIGURES

APPENDICES

1. INTRODUCTION

1.1.1 EDF Energy Nuclear Generation Limited, herein referred to as 'EDF Energy (NGL)', is seeking planning permission from East Suffolk Council (ESC) for the demolition and relocation of a number of existing facilities at Sizewell B nuclear power station (known as the Sizewell B Relocated Facilities Project and herein referred to as the 'Proposed Development'), defined by the red line boundary presented in **Figure 3-1** of this report. The facilities that would be relocated, demolished or replaced are ancillary to the process of electricity generation and have a broad range of functions.

1.1.2 On the 1st April 2019, ESC was created, covering the former districts of Suffolk Coastal District Council (SCDC) and Waveney District Council (WDC). As such, all the pre application consultation and engagement which has taken place to date with the local planning authority was carried out with SCDC and is therefore referred to as such within the documentation submitted with the planning application for the Proposed Development.

1.1.3 This report provides the results of the Flood Risk Assessment (FRA) for the Proposed Development) at locations within the existing Sizewell B power station and to the west and south of Sizewell B power station.

1.1.4 The FRA also describes how the flood risk would be managed, as well as a number of recommendations to minimise any residual impacts.

1.1.5 The assessment includes the following sections:

- a summary of relevant legislation, policy and guidance;
- a description of the existing site and of the proposed development;
- an overview of current flood risk and a summary of potential flood risk mechanisms;
- a summary of flood risk management issues, including risks posed to the development and risks posed by the development; and
- a description of residual flood risks.

2. LEGISLATION, POLICY AND GUIDANCE

2.1.1 This section identifies and describes legislation, policy and guidance of relevance to the FRA associated with the Proposed Development. Legislation and policy has been considered at a national, regional and local level. The following is considered to be relevant as it has influenced the scope and/or methodology of the assessment:

- Flood and Water Management Act 2010 (Ref. 1);
- National Planning Policy Framework (NPPF) (Ref. 2);
- National Planning Practice Guidance - Flood Risk and Coastal Change (NPPG) (Ref. 3);
- Flood Risk Assessments: Climate Change Allowances (Environment Agency) (Ref. 4);
- Suffolk Coastal Local Plan (Ref. 5); and
- Suffolk Flood Risk Management Strategy (Ref. 6).

a) National Policies and Guidance

i. Flood and Water Management Act 2010

2.1.2 The Flood and Water Management Act (FWMA) (Ref. 1) came into force in 2010. It aims to improve both flood risk management and the way we manage our water resources by creating clearer roles and responsibilities. This includes a new lead role for Local Authorities in managing local flood risk (from surface water, ground water and ordinary watercourses) and a strategic overview role for all types of flood risk for the Environment Agency. The implications of the FWMA provide opportunities for a more comprehensive, risk-based approach on land use planning and flood risk management by Local Authorities and other key partners.

ii. National Planning Policy Framework

2.1.3 The National Planning Policy Framework (NPPF) (Ref. 2) sets out the Government's planning policies for England. The NPPF (Ref. 2) seeks to ensure that flood risk is considered at all stages of the planning and development process, to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at risk of flooding.

2.1.4 The National Planning Practice Guidance (NPPG) (Ref. 3) on Flood Risk and Coastal Change supports the NPPF with additional guidance on flood risk vulnerability classifications and managing residual risks. The NPPG (Ref. 3) provides further description of Flood Zones (**Table 2-1**), Vulnerability Classifications and Compatibility in order to assess the suitability of a specific site for a certain type of development.

Table 2-1: Summary of Flood Zone Definitions

Flood Zone	Probability of Flooding	Return Periods
1	Low	Land having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
2	Medium	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%); or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% - 0.1%).
3a	High	Land having a 1 in 100 or greater annual probability of river flooding (>1%); or Land having a 1 in 200 or greater annual probability of sea flooding (>0.5%).
3b	High – Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. 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.

2.1.5 The NPPF (Ref. 2) directs development away from areas at highest risk of flooding via application of the Sequential Test. If, following application of the Sequential Test, it is not possible for a development to be located in zones with a lower probability of flooding, the Exception Test can be applied, where appropriate.

iii. Flood Risk Assessments: Climate Change Allowances

2.1.6 The Environment Agency's online advice note Flood Risk Assessments: Climate Change Allowances (Ref. 4), published in February 2016 and amended in February 2019 has been used to inform this FRA. The Environment Agency are due to provide updated guidance related to the application of the UK Climate Projections 2018; however, this has not been published at the current time. The current advice note provides guidance on the climate change allowances to be adopted taking into account geographical location, lifespan of the proposed development, flood zones, vulnerability classification associated with the type of development and critical drainage areas.

2.1.7 Guidance is provided for determining appropriate climate change allowances for fluvial, tidal and peak rainfall intensities. Further information on the application of climate change for this FRA is provided in **Section 5.b)**.

b) Local Plans

2.1.8 ESC will continue to use two Local Plans for each of the former administrative areas of Suffolk Coastal and Waveney District Councils.

i. Suffolk Coastal Local Plan

2.1.9 Suffolk Coastal District Council (SCDC) is in the process of replacing the Local Plan (Ref. 5). SCDC published their Final Draft of the Suffolk Coastal Local Plan under Regulation 19 of the Town and Country Planning (Local Planning) Regulations 2012 (as amended) (Ref. 7) with a six week period to receive representations running between January 14th and February 25th 2019. SCDC states the adoption of the plan is scheduled for November or December 2019. Accordingly, the Regulation 19 draft Local Plan has limited weight at present and the existing Local Plan (Ref. 5) and its saved policies forms part of the relevant Development Plan for the purposes of determining this planning application.

2.1.10 The existing Local Plan (Ref. 5) sets out how the area should be developed. It incorporates core strategy and development management policies and saved policies. Saved polices were updated in January 2018. Some previously saved policies have been superseded or abandoned whilst others have remained as saved policies.

2.1.11 One strategic policy and one development management policy have been identified as relevant for this development, as outlined within **Table 2-2**.

Table 2-2: Relevant Suffolk Coastal Local Plan policies

Policy Number	Policy Name	Summary
SP12	Climate Change	The District Council will contribute towards the mitigation of the effects of new development on Climate Change by minimising the risk of flooding and ensuring appropriate management of land within floodplains
DM28	Flood Risk	Proposals for new development, or the intensification of existing development, will not be permitted in areas at high risk from flooding, i.e. Flood Zones 2 and 3, unless the applicant has satisfied the safety requirements in NPPF (and any successor)

ii. Suffolk Flood Risk Management Strategy

2.1.12 Suffolk County Council (SCC) is responsible for coordinating a partnership approach to flood and coastal risk management with all risk management authorities in Suffolk. They do this through the Suffolk Flood Risk Management Partnership who produced the Local Flood Risk Management Strategy (LFRMS) in March 2016 (Ref. 6).

2.1.13 The LFRMS states the objective is *"to take a pragmatic approach to reduce the current flood risk and ensure that we do nothing to make this worse in the future"* (Ref. 6). This objective is in accordance with the principles laid out in NPPF.

2.1.14 Seven objectives of the LFRMS have been identified, two of which are most relevant to the Site:

- to prevent an increase in flood risk as a result of development by preventing additional water entering existing drainage systems wherever possible; and
- take a sustainable and holistic approach to flood and coastal management, seeking to deliver wider economic, environmental and social benefits, climate change mitigation and improvements under the Water Framework Directive. (Ref. 6).

3. DEVELOPMENT DESCRIPTION AND SCOPE OF THE FRA

a) Existing site

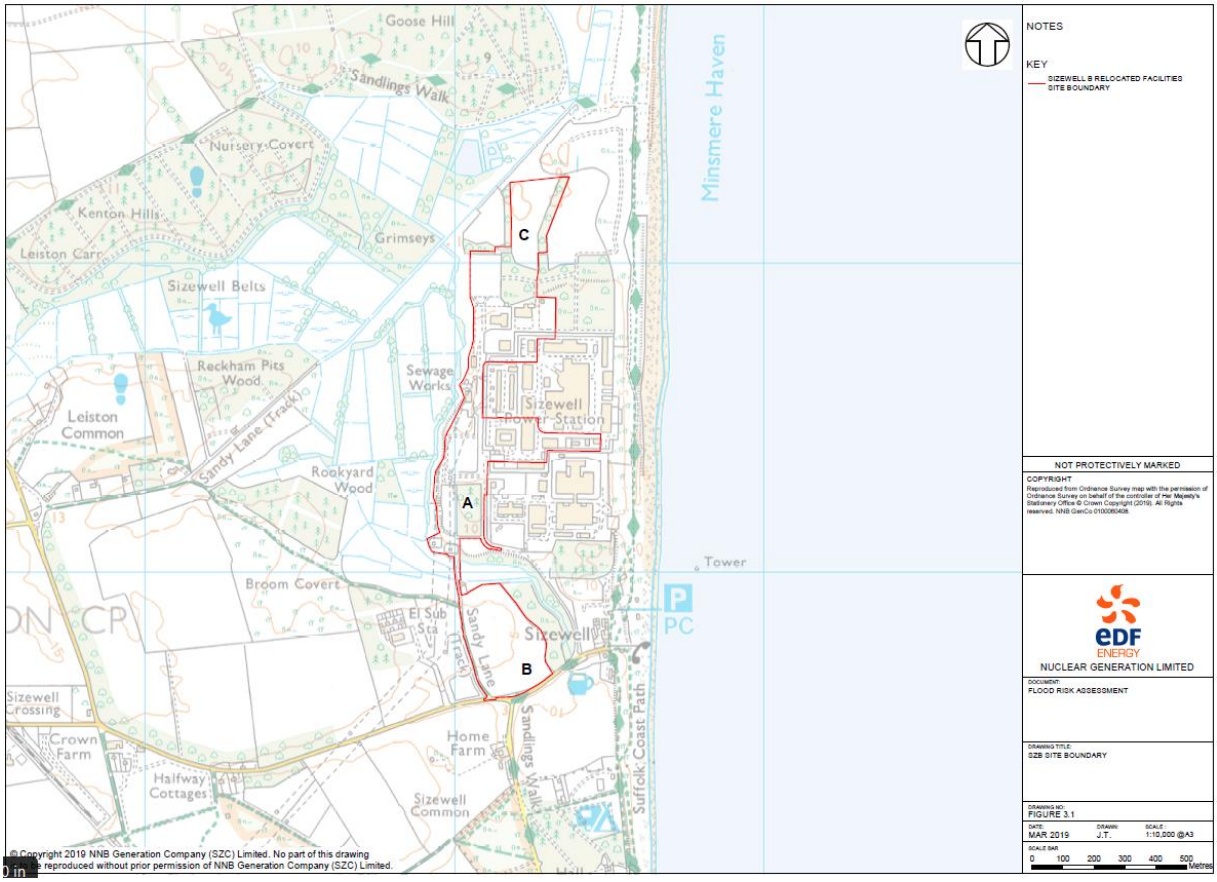
3.1.1 The Site is approximately 30.87 hectares (ha) in size and is located on the Suffolk coast, north-east of Ipswich and south of Lowestoft. The Sizewell B power station is accessed from the A12 via the B1122, Lover's Lane and Sizewell Gap Road. A private road runs northwards into the power station complex from a priority junction off Sizewell Gap Road and adjoins a network of internal roads.

3.1.2 Much of the Site is formed by the existing Sizewell B power station site, and the associated facilities. There are however some areas of undeveloped greenfield land included within the Site boundary. The Site boundary is shown in **Figure 3-1**.

3.1.3 Of the undeveloped land, three areas are named:

- 'Coronation Wood' (Marked A on **Figure 3-1**), a mixed plantation mainly comprising semi-mature and mature pine with mature broadleaf trees around the eastern, southern and south-western edges;
- 'Pillbox Field' (Marked B on **Figure 3-1**), forms the southernmost extent of the Site and is former agricultural land; and
- 'Field 2' (Marked C on **Figure 3-1**), forms the northernmost extent of the Site.

Figure 3-1: Site boundary with named undeveloped areas highlighted



b) Existing drainage

3.1.4 Sizewell B power station has an existing surface water drainage network comprising a northern and southern branch which both discharge to the sea via a single outfall. The existing surface water drainage network is shown in **Figure 2-1** in the **Surface Water Drainage Strategy** submitted with the planning application (Ref. 17).

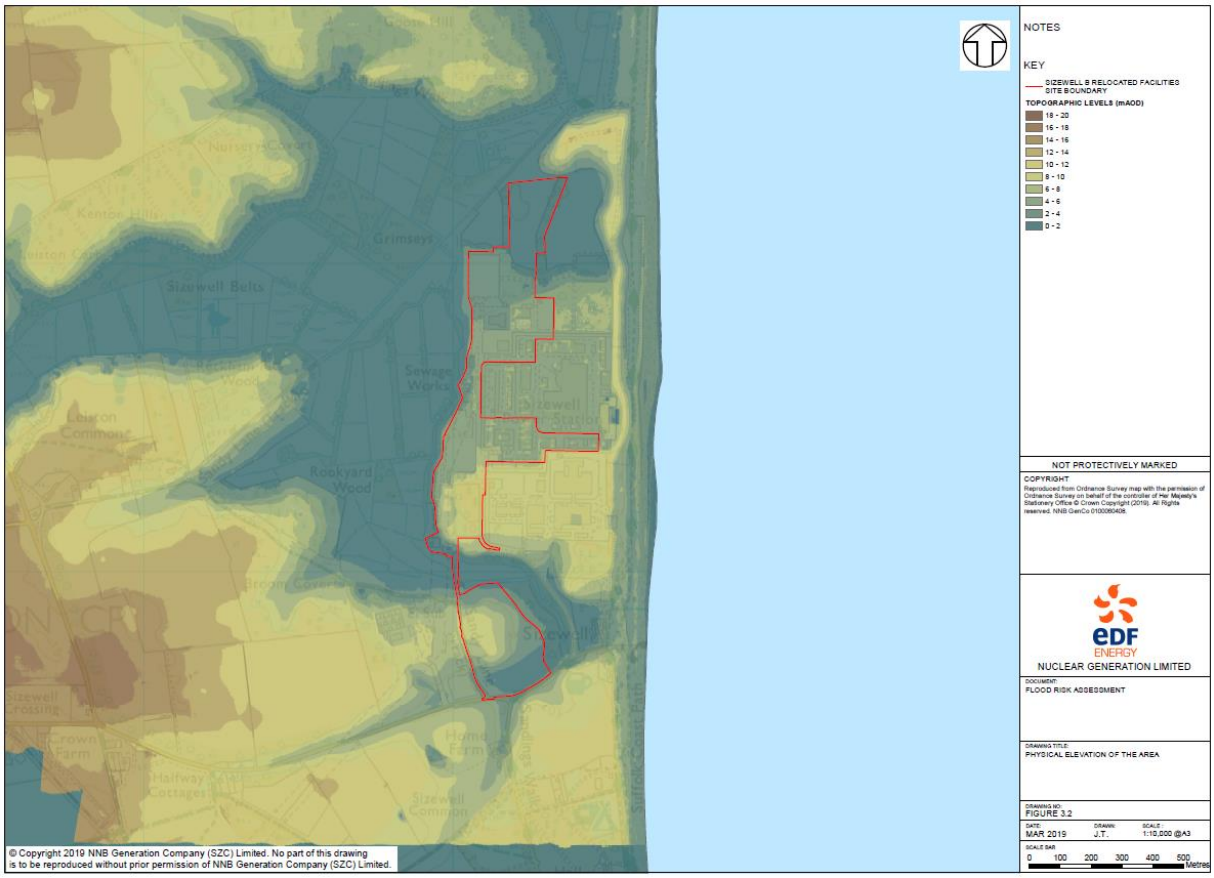
3.1.5 The northern branch comprises a pumping station to discharge surface water arising from facilities outside the Sizewell B power station perimeter at a lower level (including the existing Outage Car Park and southern portion of the Western Operational Car Park) to the surface water network within the Sizewell B power station site. The southern branch is entirely a gravity sewer network.

c) Topography

3.1.6 Remotely sensed Digital Terrain Model (DTM) LiDAR data (Ref. 8) shows the topographic levels vary across the Site (**Figure 3-2**). The Sizewell B platform is raised to approximately 6.4mAOD and as such is topographically higher than the undeveloped area of the Site to the northern extent known as Field 2.

3.1.7 Field 2 at the northern extent of the Site has a topographic level of approximately 1.8mAOD. Coronation Wood is shown to have a higher topographic level of approximately 7.9mAOD. However, the woods are relatively dense, and this elevation level may represent the top of the tree canopy and not ground level. Pillbox Field has a topography which varies between 8.6mAOD to the north-west and 1.7mAOD to the east.

Figure 3-2: Physical elevation of the area. Obtained using DTM 25cm



d) Geology

3.1.8 A detailed geological description of the area is included within **ES Volume I, Chapter 12 Land Quality**.

3.1.9 In summary, published geological records (Ref. 9) indicate that the solid geology beneath the Site comprises the Crag Group which is sands, gravels, silts and clays. Geological mapping indicates that there is Made Ground present in the north of the Site beneath which Peat deposits are present in the north western corner and Tidal Flat Deposits are present under the north eastern corner of the Site. There are Marine Beach Deposits comprising sand and gravels immediately east and Peat deposits located adjacent to the west of the Site and beneath the proposed pedestrian access from the Outage Car Park.

3.1.10 The Soilscape map (Ref. 10) shows:

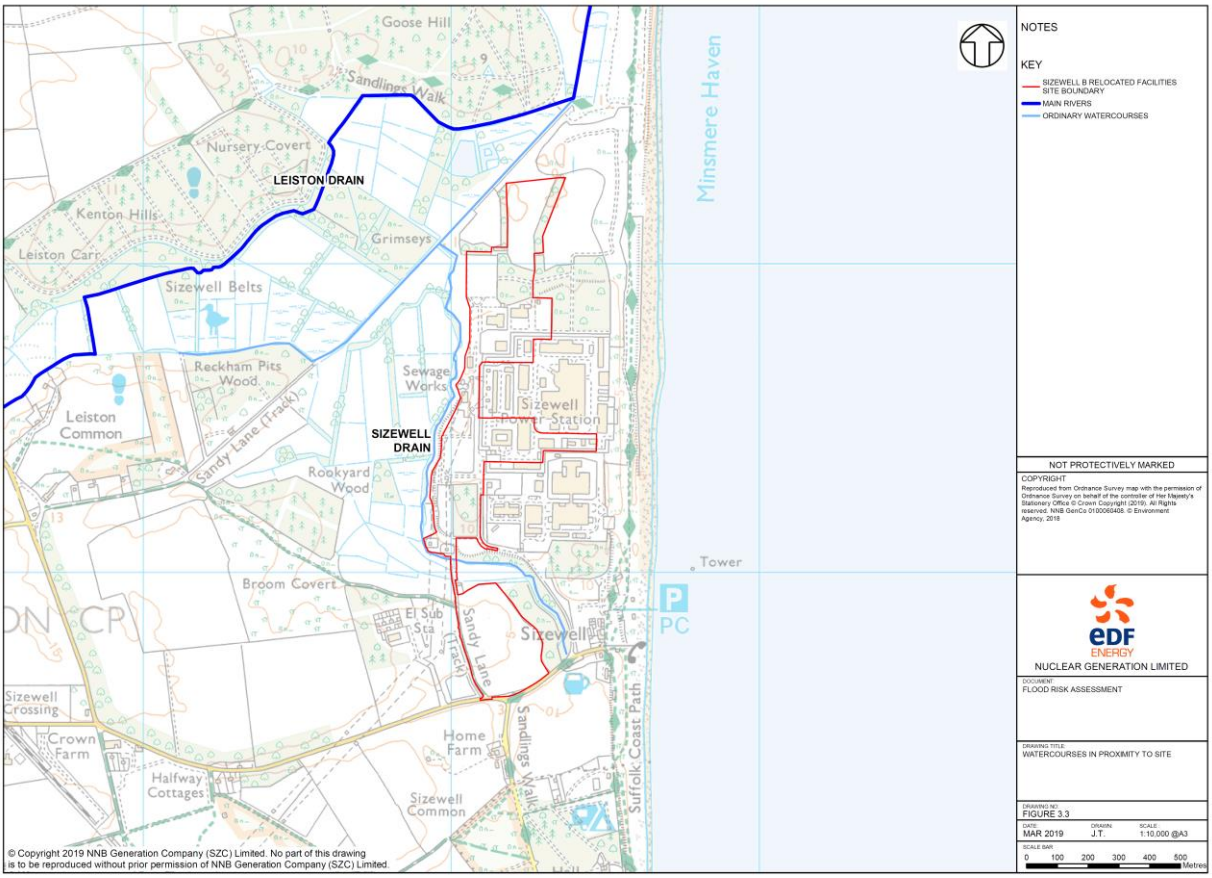
- soils associated with the bedrock located in the centre of the Site to be free draining sandy soils;
- soils associated with the superficial Peat to the west of the Site are described as naturally wet and peaty; and
- soils associated with the Tidal Flat Deposits to the north are described as naturally wet loamy and clayey soils with naturally high groundwater.

e) Hydrology

3.1.11 The Site is located to the south of the Leiston Drain, which is classified as 'Main River' by the Environment Agency (**Figure 3-3**). The Leiston Drain comprises a low energy system with extensive marshlands draining into the North Sea through the Minsmere Sluice. The Site is located adjacent to the Sizewell Belts, an area of marsh and wet woodland with multiple 'ordinary watercourses' located within it. The Sizewell Drain is located within the Sizewell Belts and flows north-eastwards before joining the Leiston Drain to the north of the Site.

3.1.12 'Main Rivers' are usually larger rivers and streams which the Environment Agency has permissive powers to maintain and improve. The Environment Agency also carry out construction and improvement works on Main Rivers to manage flood risk. Ordinary Watercourses are the remaining watercourses that are not classified as Main Rivers. Lead Local Flood Authorities (LLFA), Local Authorities (LA's) and Internal Drainage Boards (IDB) have permissive powers to carry out flood risk management work on Ordinary Watercourses.

Figure 3-3: Watercourses in proximity to site



f) Development description

3.1.13 The Proposed Development comprises the construction of replacement facilities at a number of locations within the Sizewell B power station site, followed by the demolition and removal of existing facilities (**Figure 3-4**). A new access road is also proposed at the western edge of the Site adjacent to Coronation Wood.

3.1.14 The Proposed Development is proposed to be completed in two phases. **ES Volume I, Chapter 3: Proposed Development** contains a full description of the works for each phase of construction. A brief outline of the proposed works to be carried out in each Phase is summarised below.

3.1.15 Phase One would comprise:

- Coronation Wood clearance;
- Coronation Wood Development Area construction, including the construction of the Western Access Road, Training Centre, Laydown Area and Replacement Car Park;
- Outage Store construction following demolition of the existing General Store;
- Temporary relocation of the Visitor Centre within the existing Technical Training Centre;
- Construction of Outage Car Park and associated access; and
- demolition of the existing Visitor Centre, Operations Training Centre, Outage Store and Civils Workshop and Store.

3.1.16 Phase Two would comprise:

- construction of facilities in Outline Development Zone (offices, canteen and welfare facilities);
- construction of a new Visitor Centre; and
- remaining demolition works.

i. Proposed facilities for relocation

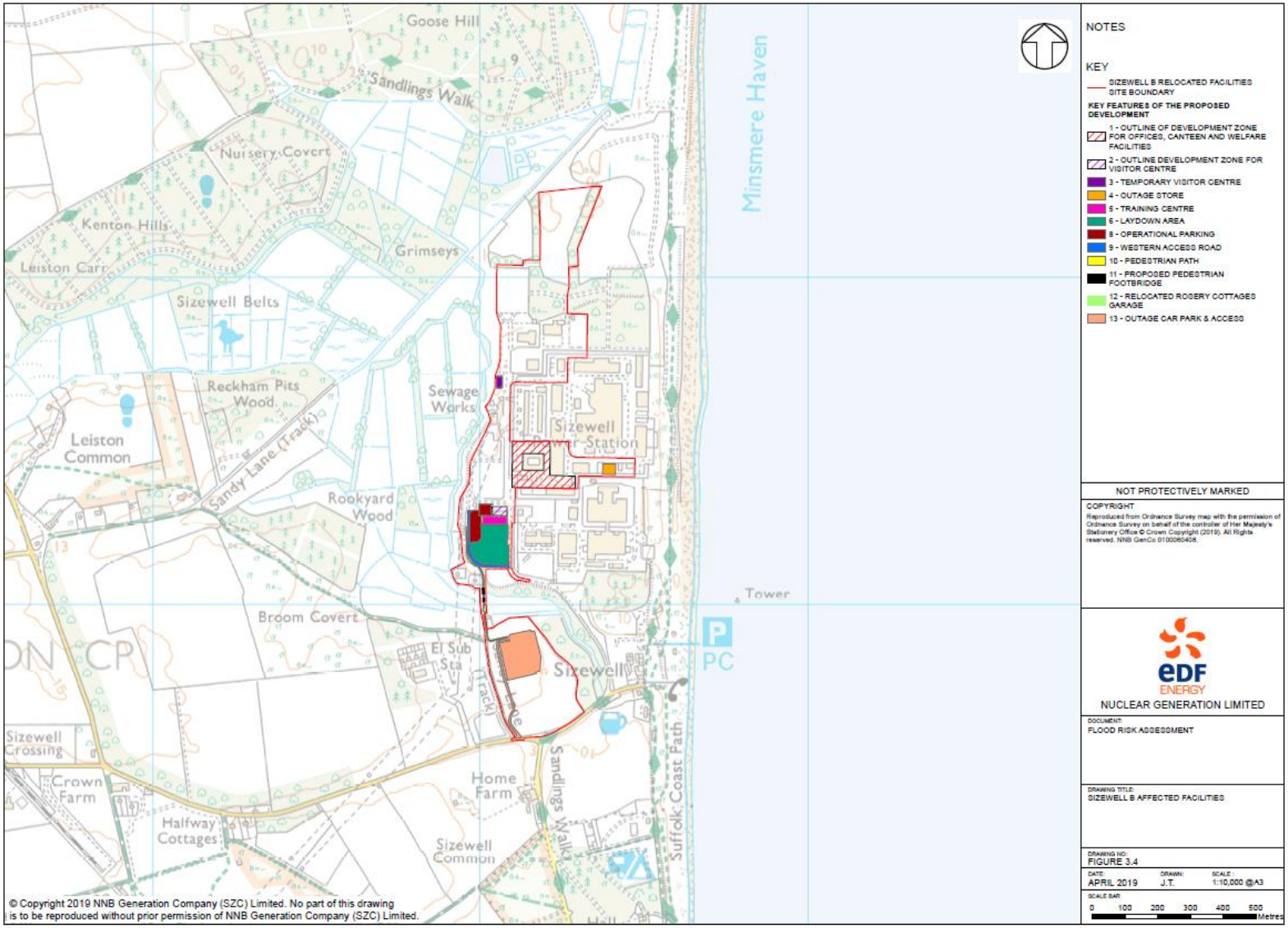
3.1.17 A number of the existing facilities at Sizewell B power station require relocation. The facilities to be relocated have a broad range of functions including industrial, administrative, educational, cultural and infrastructure. However, all are associated with the wider use of Sizewell B power station. A number of facilities are proposed to be relocated to an area known as Coronation Wood, to the south west of the Sizewell B power station. The proposed Outage Car Park and access is to be located on an area known as Pillbox Field. The proposed stockpile area is to be located on an area to the north of the Site, known as Field 2, shown on **Figure 3-1** above. The stockpile area is foreseen to be a temporary storage area, with restoration works likely to raise ground levels by approximately 0.8m across Field 2. In the alternative end-state scenario where the proposed Sizewell C power station does not go ahead then the stockpiles would be retained as part of permanent landscaping.

3.1.18 The proposed facilities and their locations within the Site are summarised in **Table 3-1** and shown on **Figure 3-4** below.

Table 3-1: Proposed facilities locations

Proposed facility name	Proposed facility location	Proposed facility location number on Figure 3-4 Error! Not a valid result for table.
Outline Development Zone for offices, canteen and welfare facilities	Inside Sizewell B station site perimeter	01
Outline development zone for Visitor Centre	North end of the Coronation Wood development area	02
Temporary Visitor Centre	North west of Sizewell B station site	03
Outage Store	Inside Sizewell B station site perimeter	04
Training Centre	North end of the Coronation Wood Development Area	05
Laydown Area	Southern end of the Coronation Wood Development Area	06
Yardsman's Office	Southern end of the Coronation Wood Development Area	07
Replacement Parking	North west of the Coronation Wood Development Area	08
Western Access Road	West and south of Coronation Wood Development Area	09
Pedestrian path	Adjacent to Western Access Road	10
Proposed pedestrian footbridge	South of Coronation Wood Development Area	11
Relocated Rosery Cottages Garage	South of Coronation Wood Development Area	12
Outage Car Park and access	Northern end of Pillbox Field	13

Figure 3-4: Proposed Site Plan Layout



4. FLOOD RISK APPRAISAL

a) Historical flooding

4.1.1 The Environment Agency has confirmed through the receipt of flood data information (Product 4 and 8) (Ref. 11) that they hold no records of flooding within the area.

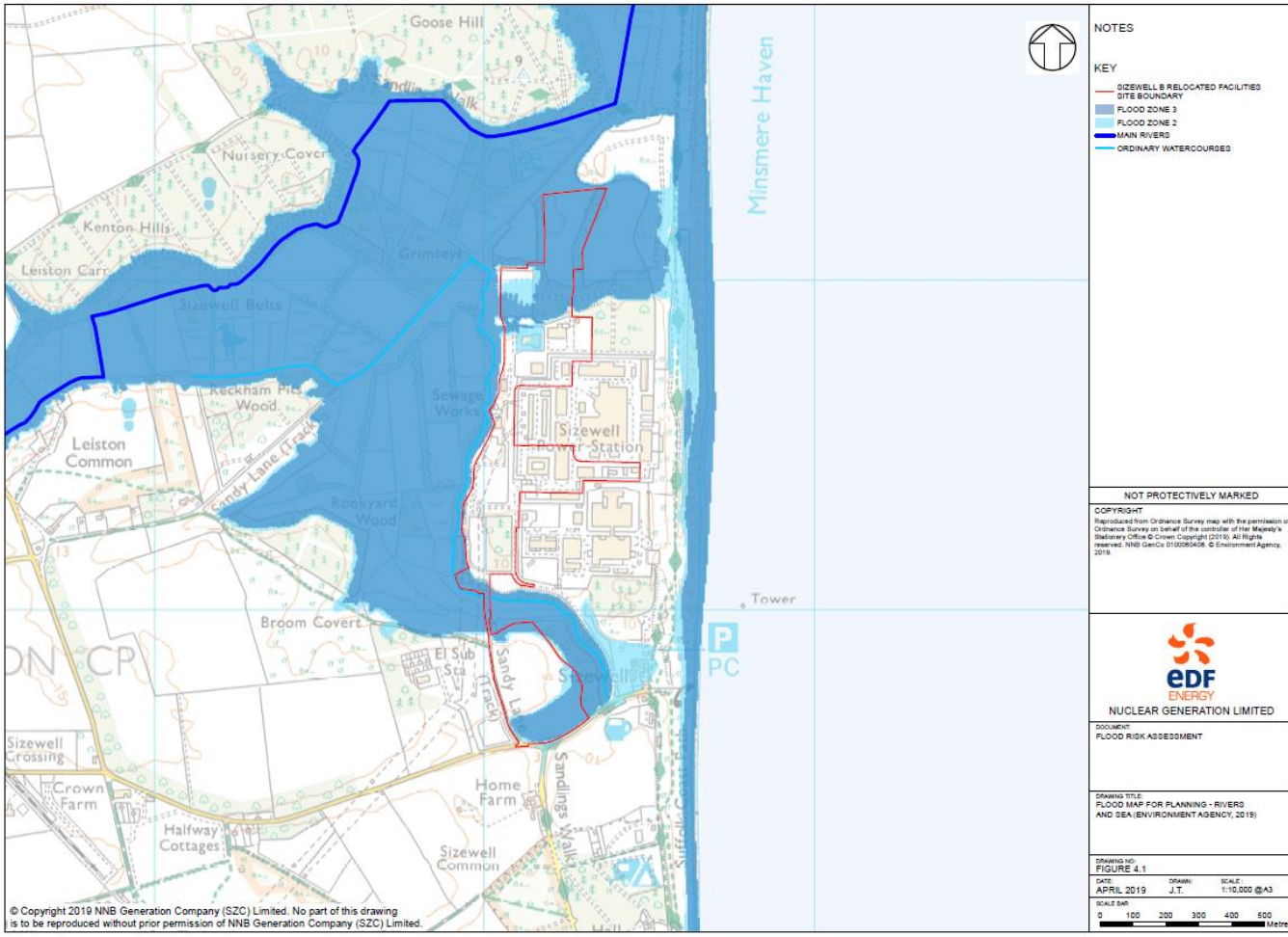
4.1.2 Following heavy rainfall in 1993, runoff from fields and impervious areas resulted in flooding within the village of Leiston. The Suffolk Coastal and Waveney District Councils Strategic Flood Risk Assessment (SFRA) (Ref. 12) states that *"both the 1993 and 2000 flood events that caused damage to many areas in Suffolk Coastal and Waveney, inundated areas of Leiston and Sizewell [town]."*

4.1.3 Anecdotal reports from Sizewell B Operations Staff suggest that surface water ponds in some on-site areas during heavy rainfall. No further data has been obtained to demonstrate that the Site itself has experienced flooding events.

b) Flood Zones

4.1.4 The Environment Agency's Flood Map for Planning (Ref. 13) identifies flood risk from rivers (fluvial) and the sea (tidal). Field 2 to the north of the Site and areas of Pillbox Field are located in Flood Zones 2 and 3, at medium and high risk of flooding from fluvial or tidal sources. All other areas are located in Flood Zone 1, at low risk of flooding from fluvial or tidal sources (**Figure 4-1**).

Figure 4-1: Flood Map for Planning - Rivers and Sea (Environment Agency 2018)



c) Tidal and coastal flood risk

4.1.5 The Environment Agency modelled water levels for both defended and undefended scenarios have been provided from the Leiston Coastal 2018 model (Ref. 11). The model shows the areas of the Site within Flood Zones 2 and 3 are affected by the undefended 1 in 200 year and 1 in 1,000 year tidal events (**Table 4-1**).

Table 4-1: Undefended modelled tidal water levels

	Undefended - modelled water level (mAOD)	
	1 in 200 year	1 in 1,000 year
Field 2	3.11	3.56
Pillbox Field	3.11	3.58

4.1.6 Field 2 has an existing topographic level of approximately 1.8mAOD and as such would be affected by approximately 1.31m of flooding during the 1 in 200 year undefended flood event and by approximately 1.76m of flooding 1 in 1,000 year undefended flood event. Following restoration ground level could be raised 0.8m to approximately 2.6mOAD. In this scenario the depth of flooding during the 1 in 200 year undefended flood event would be decreased to 0.51m and to 0.96m during the 1 in 1,000 year event.

4.1.7 Pillbox Field has a topography between approximately 1.7mAOD and 8.8mAOD. The maximum depth of flooding in this area could be 1.41m for the 1 in 200 year undefended flood event and approximately 1.88m during the 1 in 1,000 year undefended flood event.

4.1.8 A review of the Leiston Coastal 2018 model results (Ref. 11) confirms that the Site would be unaffected by coastal flooding in the defended scenario for all return periods up to the 1 in 1,000 year event.

4.1.9 Given the defended nature of the Site the risk of flooding from tidal sources is considered to be low.

d) Fluvial flood risk

4.1.10 The Environment Agency has provided modelled in-channel water levels for four nodes from the undefended scenario from the Middleton & Sizewell Study 2013 (Ref. 11). Modelled water levels are the same for all four nodes (**Table 4-2**).

Table 4-2: Undefended fluvial water levels

Node	Undefended water levels (mAOD)		
	1 in 25 year	1 in 100 year	1 in 1,000 year
EA0544056_LEIS_149	0.61	0.95	1.12
EA0544056_SIZE_003	0.61	0.95	1.12
EA0544056_SIZE_018	0.61	0.95	1.12
EA0544056_SIZE_028	0.61	0.95	1.12

4.1.11 Field 2 has an existing topographic level of approximately 1.8mAOD and following restoration could be raised by a further 0.8m. Therefore Field 2 is located topographically higher than the modelled fluvial water levels up to the 1 in 1,000 year event.

4.1.12 Pillbox Field has a minimum topographic level of approximately 1.7mAOD and therefore is located topographically higher than the modelled fluvial water levels up to the 1 in 1,000 year event.

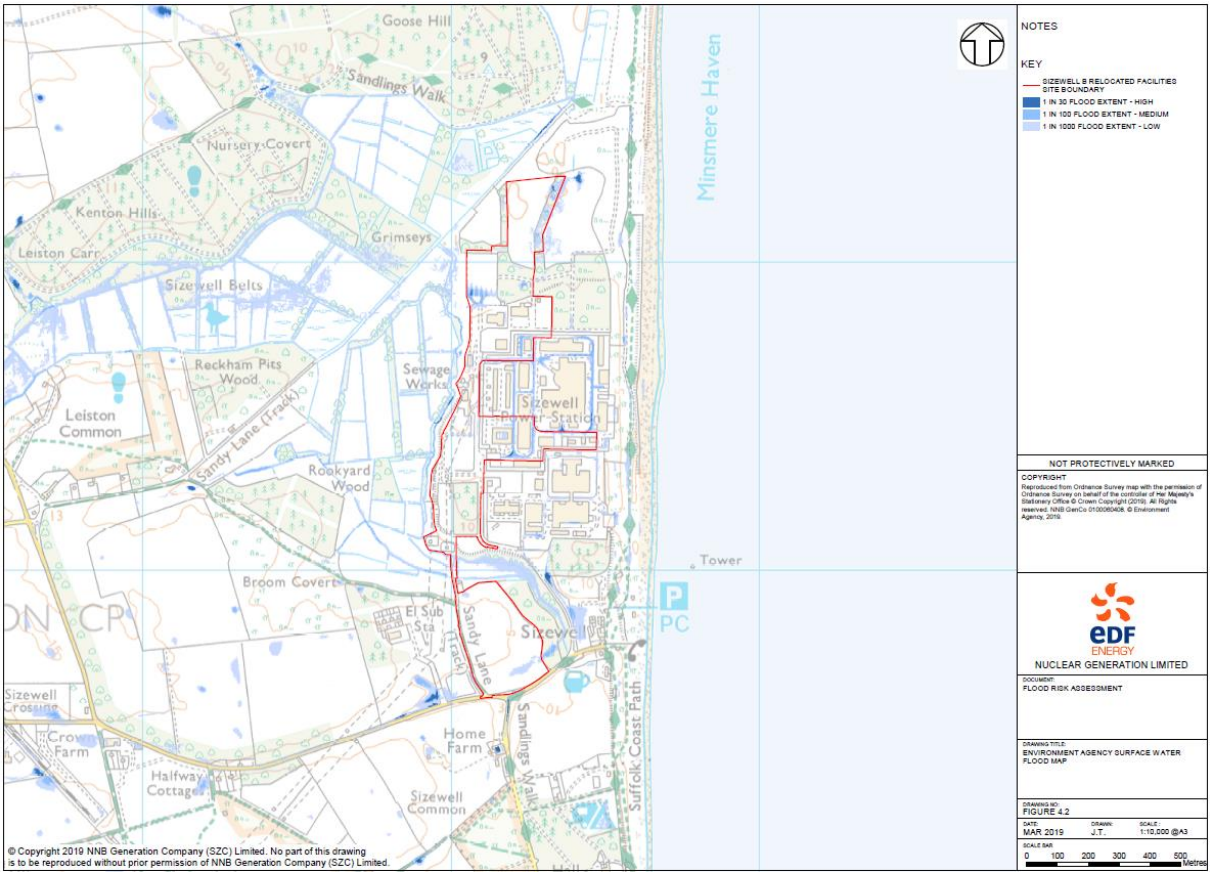
4.1.13 Analysis of topographic levels and the modelled fluvial water levels confirms the Site to be located at low risk of fluvial flooding.

e) Surface water (pluvial) flood risk

4.1.14 Surface water flooding occurs when rainwater does not drain away through the drainage system or soak into the ground but lies on or flows over the ground instead. This source of flooding can be caused by local runoff from sloping areas and impermeable areas, especially after periods of very wet weather or intense rainfall.

4.1.15 The Environment Agency's Surface Water Flood Map (Ref. 14) identifies the risk of flooding from surface water (**Figure 4-2**). The majority of the Site is at very low risk of surface water flooding. However, some areas of increased surface water flood risk (low to high) have been identified within the Site. The majority of these areas at increased risk from surface water flooding are associated with existing impermeable roads.

Figure 4-2: Environment Agency Surface Water Flood Map



f) Groundwater flood risk

4.1.16 Groundwater flooding occurs when water levels in the ground rise above surface elevation. Low-lying areas underlain by unconfined aquifers are most susceptible to this source of flooding. The latter can be the case after a prolonged rainfall event.

4.1.17 The SFRA (Ref. 12) states that there is a *'risk of groundwater flooding in the Suffolk Coastal and Waveney region'*. However, the SFRA also states there are no records of significant groundwater flooding in the region.

4.1.18 The main soil types for this area are deep well drained sandy soils, deep well drained sandy often ferruginous soils and deep stone less non-calcareous and calcareous clayey soils. These soil types tend to allow free drainage (Ref. 10).

4.1.19 Long term groundwater monitoring associated with various phases of development on the Site indicate groundwater levels within the Crag Group are typically between 0.0m AOD and 1.0m AOD.

4.1.20 The minimum topographic level identified for the Site is within Pillbox Field and is approximately 1.7m AOD.

4.1.21 As minimum ground levels are approximately 0.7m higher than the groundwater levels indicated during monitoring the overall risk of groundwater flooding is considered low.

g) Sewer flood risk

4.1.22 The Sizewell B power station site has an existing surface water drainage network comprising a northern and southern branch which both discharge to the sea via a single outfall. The northern branch is a pumped system, whilst the southern branch is gravity fed. There is a risk of flooding from the existing surface water drainage system due to surcharging or pump failure.

4.1.23 The Site is currently developed and a foul water drainage system is located within the Site. Foul water from the Sizewell B power station passes through an on-site Package Treatment Works prior to discharge via the single outfall into the sea. There is a risk of foul water flooding due to surcharging or failure of the existing sewer system.

4.1.24 There are no recorded incidents of sewer flooding affecting the Site and it is considered that the risk of sewer flooding is likely to be low.

h) Flood risk from reservoirs and other artificial sources

4.1.25 The Environment Agency states that an area is considered at risk of reservoir flooding if:

> *"peoples' lives could be threatened by uncontrolled release of water from a reservoir". (Ref. 15)*

4.1.26 The Environment Agency's Flood Map from Reservoirs (Ref. 16) shows the existing access road to the Site, an area of Pillbox Field and the proposed pedestrian footbridges are located within the maximum reservoir flood extent. The source of the reservoir flood risk to the Site is a reservoir located to the south-west of Sizewell B power station. Mapping indicates that the reservoir is located in an area known as "The Walks" (**Figure 4-3**).

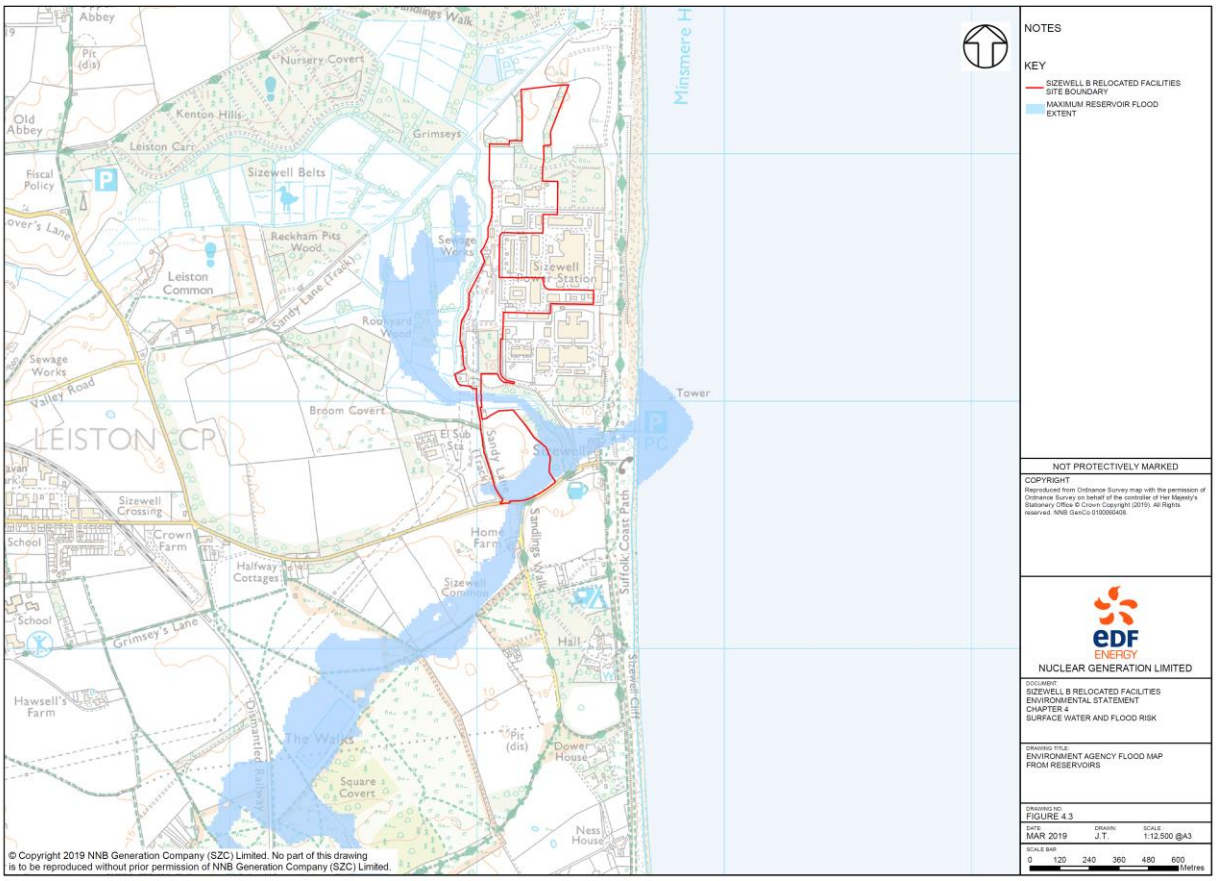
4.1.27 Flood depths at the access road are shown to be below 0.3m. However, flood depths on Pillbox Field are shown to be between 0.3m and 2m.

4.1.28 Reservoirs are subject to legislation requiring regular monitoring and maintenance. The Environment Agency states that:

> *"if a location is at risk, flooding from reservoirs is extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925" (Ref. 15)*

4.1.29 Therefore, the risk of reservoir flooding to the Site is considered to be low.

Figure 4-3: Risk of Flooding from Reservoirs



i) Summary of potential flood mechanisms

4.1.30 **Table 4-3** gives a summary of flood risk from all sources within the area of development.

Table 4-3: Summary of flood risk to the Site following analysis

Source of Flooding	Flood Risk	Explanation
Tidal	• Defended scenario: Low	• Modelled flood extents in a defended scenario show the site to be unaffected by flooding up to the 1 in 1,000 year event.
	• Undefended scenario: Low – High	• Majority of the site is located in Flood Zone 1 with a less than 1 in 1,000 annual probability of tidal flooding in any year. • A section of the access road to the Outage Car Park, the pedestrian footbridges and the stockpile area are located in Flood Zone 3.
Fluvial	• Low	• All areas of the site are topographically higher than the modelled in-channel water levels up to the 1 in 1,000 year event.

Source of Flooding	Flood Risk	Explanation
Surface water	• Majority of the Site – Very Low • Small areas of high risk, generally located along existing roads.	• Less than 1 in 1,000 annual probability of surface water flooding in any year (<0.1%). • Greater than a 1 in 30 annual probability of surface water flooding in any year (>3.3%).
Groundwater	• Low	• No records of groundwater flooding in the SFRA. • The main soil types for this area allow free drainage. • Groundwater monitoring shows groundwater levels to be between 0 – 1mAOD.
Sewers	• Low	• Existing sewer on Site, however no records of sewer flooding occurring on the Site.
Reservoirs and other artificial sources	• Low	• Southern area of Pillbox Field and access road to Coronation Wood are located within maximum reservoir flood extent. • However, the likelihood of flooding from reservoirs is classed low due to the regular inspection and maintenance reservoirs require.

5. FLOOD RISK MANAGEMENT

a) Flood Risk Vulnerability classification and Flood Zone compatibility

5.1.1 The aim of the NPPF Sequential Test (Ref. 32) is to ensure a sequential approach to new development is undertaken, steering such development to areas with the lowest probability of flooding i.e. within Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1 the Local Planning Authority (LPA), can consider reasonably available sites in Flood Zone 2. Only when there are no reasonably available sites for development in Flood Zone 1 and 2, should the suitability of sites in Flood Zone 3 be considered.

5.1.2 Following application of the Sequential Test, if it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exception Test (Ref. 3) can be applied, if appropriate. For the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
- a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

5.1.3 Both elements of the Exception Test will have to be passed for development to be allocated or permitted. Within each flood zone, surface water and other sources of flooding also need to be taken into account in applying the sequential approach to the location of development.

5.1.4 The Proposed Development comprises the construction of replacement facilities at key locations within the Site, followed by the demolition and removal of existing facilities. A new access road is also proposed at the western edge of the Site adjacent to Coronation Wood.

5.1.5 Under the flood risk vulnerability classification in the NPPG, the Sizewell B power station is classified as ‘Essential Infrastructure’ as it is described as;

“Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.”

5.1.6 However, the Proposed Development does not include works to the electricity generating elements of Sizewell B power station and is restricted to the relocation of supporting infrastructure such as offices, car parking, storage and administrative buildings.

5.1.7 Therefore, under the flood risk vulnerability classification in the NPPG, the Proposed Development would fall under the description;

"Less Vulnerable - Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure."

(NPPG (Ref. 23), Table 2: flood risk vulnerability classification)

5.1.8 As such the Proposed Development would be classified as 'Less Vulnerable' development.

5.1.9 The majority of the Site is located in Flood Zone 1, with some areas located in Flood Zones 2 and 3. It is important to note that the Flood Zone extents ignore the presence of defences.

5.1.10 The Site benefits from flood defences and does not include land where water flows or is stored in a time of flood. As such the areas of the Site within Flood Zone 3 cannot be defined as 'functional floodplain' and are classified as being Flood Zone 3a.

5.1.11 The Proposed Development layout has also employed the Sequential Approach, wherever possible, locating as many relocated facilities in Flood Zone 1 as possible. The stockpile area, proposed vehicular access road to the Outage Car Park and the pedestrian footbridges are partially located in Flood Zones 2 and 3a. The stockpile area is temporary in nature and afforded some protection from flooding by the presence of existing coastal defences.

5.1.12 In the case of the vehicular access road and the pedestrian footbridges, there are no reasonable alternatives to locating these features within Flood Zone 2 or Flood Zone 3. The pedestrian footbridge will need to cross the Sizewell Drain, and its associated flood zones, to connect the Outage Car Park to Sizewell B power station. The vehicular access road will also need to cross Flood Zone 2 and Flood Zone 3 to connect the Outage Car Park with the local road network via Sizewell Gap road.

5.1.13 'Less Vulnerable' development is considered appropriate development in Flood Zones 1, 2 and 3a and does not need to pass the Exception Test (**Table 5-1**).

5.1.14 Notwithstanding the above, the final decision regarding the application of the Sequential Test and Exception Test is for the planning authority to confirm whether they agree that the Proposed Development satisfactorily passes these tests.

Table 5-1: Flood Risk Vulnerability and Flood Zone 'Compatibility' (NPPF, Table 3)

Flood Risk Vulnerability classification		Essential Infrastructure	Water compatible	Highly vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓

Flood Risk Vulnerability classification		Essential Infrastructure	Water compatible	Highly vulnerable	More Vulnerable	Less Vulnerable
	Zone 3	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b 'Functional Floodplain'	Exception Test required	✓	×	×	×
Key: ✓ Development is appropriate × Development should not be permitted						

b) Climate change

5.1.15 The risk of flooding from all potential sources will be amplified as a result of the predicted increase in rainfall with climate change. Given the potential sources of flooding outlined in **Section 4** , there are three main aspects of climate change likely to impact the Site comprising an increase in peak river flows, an increase in extreme sea levels and an increase in the duration and intensity of rainfall events likely to affect surface water and groundwater flooding.

i. Tidal

5.1.16 The Environment Agency provided modelled tidal flood extents and levels for both defended and undefended scenarios taking into consideration climate change. For both scenarios flood extents are shown to affect land to the north and to the west of the Site. As such, water levels at Coronation Wood, as well as Pillbox Field and Field 2 are shown in **Table 5-2** and **Table 5-3**.

Table 5-2: Defended modelled tidal water levels with climate change

	Defended - modelled water level (mAOD)	
	1 in 200 year with climate change	1 in 1,000 year with climate change
Field 2	0.85	0.85
Pillbox Field	None	None
Coronation Wood	0.84	0.84

Table 5-3: Undefended modelled tidal water levels with climate change

	Undefended - modelled water level (mAOD)	
	1 in 200 year with climate change	1 in 1,000 year with climate change
Field 2	3.1	3.56
Pillbox Field	3.11	3.58
Coronation Wood	3.11	3.57

5.1.17 The Environment Agency also provided modelled tidal flood extent maps for both the defended and undefended scenarios with an allowance for climate change. Analysis of the modelled flood extent map shows all Proposed Development to be located outside the modelled defended tidal flood extents taking into consideration climate change.

ii. Fluvial

5.1.18 The Environment Agency issued updated guidance in February 2016 (amended in February 2017) on climate change allowances (Ref. 4) to be considered within Flood Risk Assessments. These allowances consider the geographical location, life span of the Proposed Development, flood zone and vulnerability classification associated with the type of development.

5.1.19 The Proposed Development is considered as 'Less Vulnerable' and is largely located in Flood Zone 1 with three areas located in Flood Zone 2 and 3a. Therefore, based on the highest flood risk, the application of the 'Central' and 'Higher Central' climate change allowance is required. The Site is located within the Anglian river basin district.

5.1.20 The proposed lifespan of the development is up to 2055. The 2050's epoch is therefore used to determine the required climate change allowance. A 'Less Vulnerable' development, using the 2050's epoch and higher central allowance in the Anglian river basin is required to use a 20% allowance for climate change (**Table 5-4**).

Table 5-4: Peak river flow allowances by river basin district (use 1961 to 1990 baseline) (Source: Table 1, Environment Agency Climate Change Allowances 19/02/2016)

River basin district	Allowance category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Anglian	Upper end	25%	35%	65%
	Higher central	15%	20%	35%
	Central	10%	15%	25%

5.1.21 The Environment Agency flood data (Ref. 11) includes modelled fluvial water levels for the 1 in 100 year undefended event with a 20% allowance for climate change and a modelled flood extent map. Analysis of the modelled flood extent map shows the Proposed Development would be located outside the 1 in 100 year flood extent when including an allowance for climate change. Modelled water levels are shown to be 1.01mAOD (**Table 5-5**).

Table 5-5: Undefended fluvial water levels with climate change

Node	Undefended water levels with climate change (mAOD)
	1 in 100 year + 20%
EA0544056_LEIS_149	1.01
EA0544056_SIZE_003	1.01

iii. Rainfall

5.1.22 The Environment Agency guidance on peak rainfall intensity allowances that are to be taken into account for climate change are outlined in **Table 5-6**. The Site is not within a Critical Drainage Area. In accordance with the guidance, both the Central (10%) and Upper End (20%) allowances would need to be considered within the design to assess the range of impact both on and off site for the 2040 – 2069 epoch (**Table 5-6**).

Table 5-6: Peak rainfall intensity allowance in small and urban catchments (use 1961-90 baseline) (Source: Table 2, Environment Agency Climate Change Allowances 19/02/2016 (Ref. 4))

	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

c) Impacts of flood risk on the development

5.1.23 **Section 4** outlines the existing flood risk and **Section 5.b)** outlines the future flood risk posed to the Site as a result of climate change factors. A comparison of the proposed site plan layout with the existing flood extents indicates the areas of the Proposed Development with the most significant flood risk. The proposed site layout plan has also been compared with future modelled water levels and flood extents to provide an understanding of the future flood risk posed to the Site. This enables a review of the potential for flooding to affect the Proposed Development.

5.1.24 **Table 5-7** presents a summary of the existing flood risk and **Table 5-8** presents a summary of future flood risk to the Proposed Development facilities from all sources taking into consideration flood defences.

Table 5-7: Existing defended flood risk for the Proposed Development

Proposed facility	Source of flooding					
	Tidal / coastal	Fluvial	Surface water	Groundwater	Sewer	Reservoir
Outline Development Zone for offices, canteen and welfare facilities	Low	Low	Very Low to High	Low	Low	None
Visitor Centre	Low	Low	Very Low	Low	Low	None
Temporary Visitor Centre	Low	Low	Very Low	Low	Low	None
Outage Store	Low	Low	Very Low	Low	Low	None
Training Centre	Low	Low	Very Low	Low	Low	None
Laydown Area	Low	Low	Very Low	Low	Low	None
Yardsman's Office	Low	Low	Very Low	Low	Low	None
Replacement Parking	Low	Low	Very Low	Low	Low	None
Western Access Road	Low	Low	Very Low	Low	Low	None
Pedestrian path	Low	Low	Very Low	Low	Low	None
Proposed pedestrian footbridges	Low	Low	Very Low	Low	Low	Low
Relocated Rosary Cottages Garage	Low	Low	Very Low	Low	Low	None
Outage Car Park and access	Low	Low	Very Low	Low	Low	Low

Table 5-8: Future flood risk for the proposed development with climate change

Proposed facility	Source of flooding					
	Tidal / coastal	Fluvial	Surface water	Groundwater	Sewer	Reservoir
Outline Development Zone for offices, canteen and welfare facilities	Low	Low	No future flood extents available	No future flood probability available	To be addressed by the Drainage Strategy	No future flood extents available
Visitor Centre	Low	Low				
Temporary Visitor Centre	Low	Low				
Outage Store	Low	Low				
Training Centre	Low	Low				
Laydown Area	Low	Low				
Yardsman's Office	Low	Low				
Replacement Parking	Low	Low				
Western Access Road	Low	Low				
Pedestrian path	Low	Low				

Proposed facility	Source of flooding					
	Tidal / coastal	Fluvial	Surface water	Groundwater	Sewer	Reservoir
Proposed pedestrian footbridges	Low	Low				
Relocated Rosary Cottages Garage	Low	Low				
Outage Car Park and access	Low	Low				

5.1.25 The Surface Water Drainage Strategy for the Proposed Development (Ref. 17) proposes that facilities within the existing Sizewell B power station perimeter (i.e. the Outage Store and facilities within the Outline Development Zone) will be drained to the existing below ground surface water drainage network. Surface water runoff in exceedance events (i.e. greater than 1 in 100 year rainfall event) would be addressed through overland flow.

5.1.26 The Surface Water Drainage Strategy proposes that facilities located outside of the existing Sizewell B power station perimeter (i.e. facilities within Coronation Wood and Pillbox Field) will be drained principally by infiltration techniques. The proposed drainage will be independent from the existing surface water drainage system on the Site. An exception to this is the temporary location of the Visitor Centre, which comprises a refurbishment of the existing Technical Training Centre, and therefore will follow the existing drainage principles in that location (Ref. 17 and Ref. 18).

5.1.27 The use of infiltration could increase the risk of flooding from groundwater if water table levels were close to the surface. However, the Surface Water Drainage Strategy concludes the following:

> *"a static groundwater level of +1.0mOD is therefore recommended for design purposes."*
>
> *(Ref. 18)*

5.1.28 Furthermore, the Surface Water Drainage Strategy concludes that:

> *The groundwater level is sufficiently deep that it would not appear to present any impediment to infiltration techniques."*
>
> *(Ref. 18)*

d) Changes to flood risk

i. During construction

5.1.29 Where practicable, contractors should avoid locating temporary structures, such as accommodation, and the placing of construction equipment within Flood Zone 3 or areas at significant risk of flooding from other sources.

5.1.30 The stockpile area, proposed vehicular access road to the Outage Car Park and the pedestrian footbridges are partially located in Flood Zones 2 and 3a. However the Site

benefits from coastal flood defences. Due to the presence of coastal defences the Site does not act as "functional floodplain" (Flood Zone 3b) and therefore the risk of flooding from fluvial and tidal sources is considered to be a residual risk. As a result, the presence of defences ensures that Proposed Development within Flood Zone 2 and 3a will not directly increase flood risk to off-site receptors.

5.1.31 Should an area be needed for material storage within Flood Zone 3a it is acknowledged that during the construction stage a plan of evacuation / safe removal of materials / safeguarding materials during a flood event will be required.

5.1.32 Bunds could be put in place to safeguard the area should there be overtopping or a breach in the defences resulting in flooding, however, this would need to show that any flow paths are not altered and flood risk is not increased.

5.1.33 Drainage of the Site during construction will not result in an increased risk of flooding from any source.

ii. During operation

5.1.34 The stockpile area, proposed vehicular access road to the Outage Car Park and the pedestrian footbridge are partially located in Flood Zones 2 and 3a. However, the Site benefits from the presence of coastal flood defences. Due to the presence of these defences, the Site is not classified as "functional floodplain" (Flood Zone 3b) and therefore the risk of flooding from fluvial and tidal sources to these facilities is considered to be a residual risk (i.e. it could only occur if the existing defences were to be breached or overtopped) rather than an actual risk. The location of these components of the Proposed Development within Flood Zone 2 and 3a is such that flooding would only occur if there were overtopping or a breach in the defences and therefore will not increase flood risk to off-site receptors.

5.1.35 The relocated facilities have been located sequentially outside of the modelled 1 in 100 year with climate change defended fluvial flood extent and the modelled 1 in 200 year with climate change defended tidal flood extent. As such, the Proposed Development would have no effect on the defended fluvial or tidal flood risk.

5.1.36 The basic premise for the Proposed Development is that the new facilities would replicate the use of existing facilities on a like-for-like basis. However, in a number of cases there is a requirement to increase the building area in order to meet current regulation and industry standards. This increase would be attenuated using permeable solutions and soakaways. As such, the Proposed Development would have no negative impact on surface water or sewer flood risk.

5.1.37 Two facilities are located within the maximum reservoir flood extent, however the risk of flooding from this source is considered to be low. As such, the Proposed Development would have no negative effect on reservoir flood risk.

5.1.38 The permanent Site drainage system will incorporate a range of measures to ensure that the Proposed Development is not at risk of flooding from surface water sources. The drainage system also ensures that surface water flood risk does not increase to off-site receptors.

e) Applicability of SuDS

5.1.39 In order to manage surface water drainage, it is necessary to consider the appropriateness of a variety of Sustainable Drainage System (SuDS) measures.

5.1.40 To assess the potential suitability of the SuDS techniques, the SuDS management train should be considered to understand potential opportunities to limit or attenuate surface water drainage from the Site. This approach focuses on source control, site control and regional control, with source control being the preferred option.

5.1.41 The SuDS Manual (2015) (Ref. 19) identified the following:

- source control – control of runoff at or very near its source (e.g. soakaways, other infiltration methods, green roofs, pervious pavements);
- site control – management of water in a local area of site (e.g. routing water from building roofs and car parks to a large soakaway, infiltration or detention basin); and
- regional control – management of runoff from a site or several sites, typically in a balancing pond or wetland.

5.1.42 The bedrock geology of the area is the Crag Group (marine deposits), formed of sand. The majority of the Site does not have any superficial geology. However, Field 2 is shown to have superficial deposits of Tidal Flat Deposits and the northern area of Pillbox Field is shown to have superficial deposits of Peat. Therefore, the ground conditions are likely be suitable for the use of infiltration drainage. Details of the considerations into appropriate SuDS options are within the Surface Water Drainage Strategy (Ref. 17).

f) Water management and drainage

5.1.43 The Surface Water Drainage Strategy (Ref. 17 and Ref. 18) has been developed so that there are no adverse effects on the existing surface water drainage system.

5.1.44 The principles of surface water drainage for the Proposed Development have been determined based on the particular location of the facilities, either inside or outside the existing Sizewell B power station. This can be summarised as:

- facilities outside the existing Sizewell B power station (i.e. within the Coronation Wood Development Area and Pillbox Field) would be drained principally by infiltration techniques. This will be independent from the existing surface water drainage system on the Site; and
- facilities inside the existing Sizewell B power station (i.e. the Outage Store and facilities within the Outline Development Zone) would be drained directly to the existing below ground drainage system. Surface water runoff in exceedance events (i.e. greater than 1 in 100 year rainfall event) would be addressed through overland flow.

5.1.45 The Surface Water Drainage Strategy (Ref. 17 and Ref. 18) is designed to:

- ensure no surface water flooding from piped networks occurs during a 1 in 30 year rainfall event (+ 20% climate change allowance);
- emulate greenfield runoff characteristics, where practicable, so that the existing drainage network is not subject to additional loading;
- intercept and retain the first 5mm of every rainfall event as far as is reasonably practicable; and
- incorporate SuDS features such as permeable paving and swales, with appropriate oil / fuel controls, such as formal oil separators, where necessary.

5.1.46 Details of the proposed drainage strategy for each of the relocated facilities are included within the separate Surface Water Drainage Strategy (Ref. 17).

6. RESIDUAL RISK

6.1.1 There is always a potential for there to be a residual flood risk to people and property due to the failure of systems and defences, or more extreme events than those defined in the NPPF, or uncertainties associated with modelled water levels. Residual risk may remain after flood management or mitigation measures have been installed. Therefore, an FRA should consider the residual flood risk to the Proposed Development and identify the need for any further mitigation measures to ensure the residual risk is managed appropriately.

6.1.2 There is a potential residual risk to the Site should the existing and proposed surface water and foul water drainage systems fail. The risk of flooding from surface water drainage and foul sewers due to failure of the system would be addressed as part of the drainage design within the Surface Water Drainage Strategy (Ref. 17).

6.1.3 Both SuDS and traditional drainage systems require regular maintenance to ensure continuing operation to design performance standards. Poor maintenance would result in increased risk of flooding from surface water. Maintenance plans or schedules need to be developed for the Site.

6.1.4 The Site benefits from the presence of tidal / coastal flood defences and therefore the Proposed Development is at residual risk of flooding from tidal sources should these defences fail.

6.1.5 Details of flood hazard and flood depths following coastal defence breach at breach location 'Leiston 001' has been provided as part of the flood data information received from the Environment Agency (Ref. 11). This breach mapping has considered the 1 in 200 year and 1 in 1,000 year flood event for both present day and considering climate change.

6.1.6 The breach location 'Leiston 001' is located to the north of the Minsmere Level, however the modelled breach flood extents extend south beyond the Sizewell B power station site. The breach extent map provided does not extend to cover the full extent of the southern area of Pillbox Field.

6.1.7 The Environment Agency state that the breach mapping considers the consequences of a breach and does not consider the likelihood of a breach occurring. A breach is less likely to occur where defences are in good condition, however a residual risk of breach remains.

6.1.8 **Table 6-1** provides a summary of the maximum flood depths and the associated hazard ratings for the area adjacent to the western boundary of the Site, should there be a failure in the defences. It is important to note that whilst the consequences of a failure in the defences is significant the importance of the tidal / coastal defences in this location is such that they are subject to regular inspection to ensure their continued integrity.

6.1.9 The Site is located in Policy Development Zone 4 in the Shoreline Management Plan SMP7 (previously Sub-Cell 3C) Lowestoft Ness to Felixstowe Landguard Point and the policy in this location is Hold the Line to ensure the continued protection of the Sizewell

power station complex (Ref. 20). Therefore, the likelihood of a failure in the defences is low.

Table 6-1: Breach flood depth and hazard

	Maximum depth (m)	Hazard rating
1 in 200 year – present day	1.00 – 1.50	Danger for most
1 in 1,000 year – present day	1.50 – 2.00	Danger for most
1 in 200 year – with climate change	> 2.00	Danger for all
1 in 1,000 year – with climate change	> 2.00	Danger for all

7. SUMMARY AND CONCLUSIONS

7.1.1 This report has considered all sources of flood risk posed to the Site and the Proposed Development.

7.1.2 The Site is located in Flood Zone 1, 2 and 3a. The Proposed Development is classed as 'Less Vulnerable' under the NPPF. Less Vulnerable development is considered acceptable in Flood Zones 1, 2 and 3a.

7.1.3 **Table 4-3,** reproduced below as **Table 7-1** shows the Site is largely at low risk of flooding from all sources during a defended scenario. The exception to this relates to small areas of increased surface water flood risk generally associated with existing roads on the Site.

Table 7-1: Summary of flood risk to the Site (reproduced from Table 4-3**)**

Source of Flooding	Flood Risk	Explanation
Tidal	• Defended scenario: Low	• Modelled flood extents in a defended scenario show the Site to be unaffected by flooding up to the 1 in 1,000 year event.
	• Undefended scenario: Low – High	• Majority of the Site is located in Flood Zone 1 with a less than 1 in 1,000 annual probability of tidal flooding in any year. • Two areas on the Site are located below the 1 in 200 year modelled water level. • The same two areas are also located below the 1 in 1,000 year modelled water level. These areas are not proposed to be developed.
Fluvial	• Low	• All areas of the Site are topographically higher than the modelled in-channel water levels up to the 1 in 1,000 year event.
Surface water	• Majority of the Site – Very Low • Small areas of high risk, generally located along existing roads on the Site.	• Less than 1 in 1,000 annual probability of surface water flooding in any year (<0.1%). • Greater than a 1 in 30 annual probability of surface water flooding in any year (>3.3%).
Groundwater	• Low	• No records of groundwater flooding in the SFRA. • The main soil types for this area allow free drainage. • Groundwater monitoring shows groundwater levels to be between 0 – 1mAOD.
Sewers	• Low	• Existing sewer on Site, however no records of sewer flooding occurring on the Site.

Source of Flooding	Flood Risk	Explanation
Reservoirs and other artificial sources	• Low	• Southern area of Pillbox Field and access road to Coronation Wood are located within maximum reservoir flood extent. • However, the likelihood of flooding from reservoirs is classed as low due to the regular inspection and maintenance reservoirs require.

7.1.4 The impacts of the existing defended flood risk on the Proposed Development is detailed in **Table 5-7**. This shows that the Proposed Development will be located in areas of low present day flood risk from tidal, fluvial, groundwater, sewer and reservoir sources. All proposed facilities are also shown to be at very low surface water flood risk, except facilities located within the Outline Development Zone which has areas of increased surface water flood risk; however, surface water runoff in this area will be designed such that it drains directly into the existing drainage system as set out in Surface Water Drainage Strategy (Ref. 17).

7.1.5 Details of the effects of climate change on tidal and fluvial flooding is presented in **Table 5-8**. This has confirmed that all proposed facilities would remain at low risk of flooding from tidal and fluvial sources in the future.

7.1.6 The Site benefits from tidal flood defences and as such the flood risk from this source is classed as a residual risk of flooding due to a breach or overtopping of the defences.

The Surface Water Drainage Strategy (Ref. 17 and Ref. 18) will ensure that drainage on and off the site is managed effectively. This has been designed to ensure that no surface water flooding from piped networks occurs during a 1 in 30 year rainfall event (+ 20% climate change allowance), whilst emulating greenfield runoff characteristics, where practicable. This will ensure that the existing drainage network is not subject to additional loading and prevent any changes to flood risk.

8. REFERENCES

Ref. 1 Flood and Water Management Act 2010, web-based resource available at https://www.legislation.gov.uk/ukpga/2010/29/contents

Ref. 2 National Planning Policy Framework, Department for Communities and Local Government, February 2019

Ref. 3 National Planning Practice Guidance – Flood Risk and Coastal Change, web-based resource available at http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/, Department for Communities and Local Government, March 2014

Ref. 4 Flood Risk Assessment: Climate Change Allowances, web-based resource available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances, Environment Agency, February 2016

Ref. 5 Suffolk Coastal District Local Plan, Core Strategy & Development Management Policies, Suffolk Coastal District Council, July 2013

Ref. 6 Suffolk Flood Risk Management Strategy (LFRMS), The Suffolk Flood Risk Management Partnership, March 2016.

Ref. 7 The Town and Country Planning (Local Planning) (England) Regulations 2012

Ref. 8 LIDAR Digital Terrain Model 25cm Tiles, Department for Environment, Food and Rural Affairs, 2016.

Ref. 9 Geology of Britain viewer, web-based resource available at http://mapapps.bgs.ac.uk/geologyofbritain/home.html , British Geological Survey, 2014.

Ref. 10 Soilscape on the MAGIC viewer, web-based resource available at http://magic.defra.gov.uk/MagicMap.aspx, Defra, accessed July 2018.

Ref. 11 Environment Agency, Flood data information, Product 4 and 8. Received January 2019.

Ref. 12 Suffolk Coastal and Waveney District Councils Strategic Flood Risk Assessment, Scott Wilson, January 2009.

Ref. 13 Environment Agency Flood Map for Planning, web-based resource available at http://maps.environment-agency.gov.uk/, Environment Agency, accessed June 2018.

Ref. 14 Environment Agency's Surface Water Flood Map, web-based resource available at http://maps.environment-agency.gov.uk/, Environment Agency, accessed June 2018.

Ref. 15 Long term flood risk information, web-based resource available at https://flood-warning-information.service.gov.uk/long-term-flood-risk/risk-types, Environment Agency, accessed January 2019.

Ref. 16 Environment Agency's Reservoir Flood Map, web-based resource available at http://maps.environment-agency.gov.uk/, Environment Agency, accessed June 2018.

Ref. 17 Sizewell B Relocated Facilities Surface Water Drainage Strategy, Revision 7, Atkins, March 2019.

Ref. 18 Technical Review of Sizewell B Relocated Facilities Drainage and Water Management Strategy, Atkins, January 2019.

Ref. 19 The SuDS Manual (C753), CIRIA.

Ref. 20 First Review of Shoreline Management Plan SMP7 (previously Sub-Cell 3C) Lowestoft Ness to Felixstowe Landguard Point, Suffolk Coastal District Council January 2010.

9. GLOSSARY OF TERMS

Term	Definition
Baseline	The flood risk conditions that currently exist on the site and in the surrounding area.
Exception Test	A method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.
Groundwater	Water occurring below ground in natural formations (typically rocks, gravels and sands).
Internal Drainage Board	A type of operating drainage authority that is established in defined areas in England and Wales with permissive powers to manage water levels within their associated drainage districts.
Lead Local Flood Authority	Lead Local Flood Authorities are normally county councils or unitary authorities. They lead in managing local flood risks from surface water, groundwater and ordinary watercourses. They are also involved in some aspects of coastal flood management.
LiDAR	Light Detection and Ranging is a remote sensing method used to examine the surface of the Earth.
Main River	Main Rivers are a statutory type of watercourse in England and Wales, usually larger streams and rivers, but also include some smaller watercourses. The Environment Agency's powers to carry out flood defence works apply to main rivers only. In England main rivers are designated by Defra. Every other open watercourse in England and Wales is determined by statute as an 'ordinary watercourse'.
Ordinary Watercourse	Ordinary Watercourses include every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows and which does not form part of a main river.
Sequential Test	The Sequential Test aims to steer new development toward areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for that development in areas of lower probability of flood risk.
Sustainable Drainage Systems (SuDS)	Sustainable drainage systems (SuDS) are drainage solutions that aim to provide an alternative to the direct channelling of surface water through networks of pipes and sewers to nearby watercourses, using techniques such as ground infiltration and storage in ponds.

10. LIST OF ABBREVIATIONS

Abbreviation	Term
CFMP	Catchment Flood Management Plan
FRA	Flood Risk Assessment
FWMA	Flood and Water Management Act
IDB	Internal Drainage Board
LA	Local Authority
LLFA	Lead Local Flood Authority
OS	Ordinance Survey
AODN	Above Ordnance Datum Newlyn
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
PFRA	Preliminary Flood Risk Assessment
SFRA	Strategic Flood Risk Assessment

APPENDIX 1A ENVIRONMENT AGENCY PRODUCT 4 & 8 DATA

[redacted]

From: Enquiries_EastAnglia <Enquiries_EastAnglia@environment-agency.gov.uk>
Sent: 10 January 2019 09:36
To: Royal HaskoningDHV FloodRisk UK
Subject: EAN/2018/109626 EA Product 4, 5 and 8 data request - Sizewell, Suffolk
Attachments: Leiston Breach Maps Product 8.pdf; product 4.pdf; 109626 2018 01 10 Response 4and8.pdf

Dear [redacted]

Please find attached our Products 4 & 8 for the below enquiry.

Product 8 Data
The following Breach maps shows the extent of a 1:200 defended flood event with and without climate change and a 1:1000 defended flood event with and without climate change with the additional impacts of a breach at specified locations. Therefore it is important to clarify that only the area immediately surrounding the breach will show impacts upon depth and hazard levels. The rest of the extent will remain the same as the current defended flood outlines.

We are unable to send you Product 5 as this information is not available as yet. We hope to have it within the next couple of weeks. We will keep your enquiry open and send you the Product 5 information as soon as we have it.

Kind regards

[redacted]
Customers & Engagement Officer, Customers & Engagement Team, East Anglia Area
Environment Agency | Bromholme Lane, Brampton, Huntingdon, Cambridgeshire, PE28 4NE

Environment Agency | Iceni House, Cobham Road, Ipswich IP3 9JD

enquiries_eastanglia@environment-agency.gov.uk
External: 0203 02 55472

From: Royal HaskoningDHV FloodRisk UK [mailto:FloodRisk.UK@rhdhv.com]
Sent: 07 December 2018 10:05
To: Enquiries_EastAnglia <Enquiries_EastAnglia@environment-agency.gov.uk>; Enquiries, Unit <enquiries@environment-agency.gov.uk>

Cc [redacted]
Subject: EA Product 4, 5 and 8 data request - Sizewell, Suffolk

Dear Sir or Madam

I would like to request the following flood data products;

- Product 4; detailed flood risk assessment data package to include maps of flood zones, defences and storage areas, areas benefitting from defences and historic flood event outlines. We also require more detailed information including model extent, information on specific points and flood levels and flood flows for all available return periods.

- Product 5; flood modelling reports and hydrology reports.

- Product 8; flood defence breach hazard map including, maximum flood depth, maximum flood velocity, maximum flood hazard if this is available for the site.

We require the above products for an area in proximity to the following address;

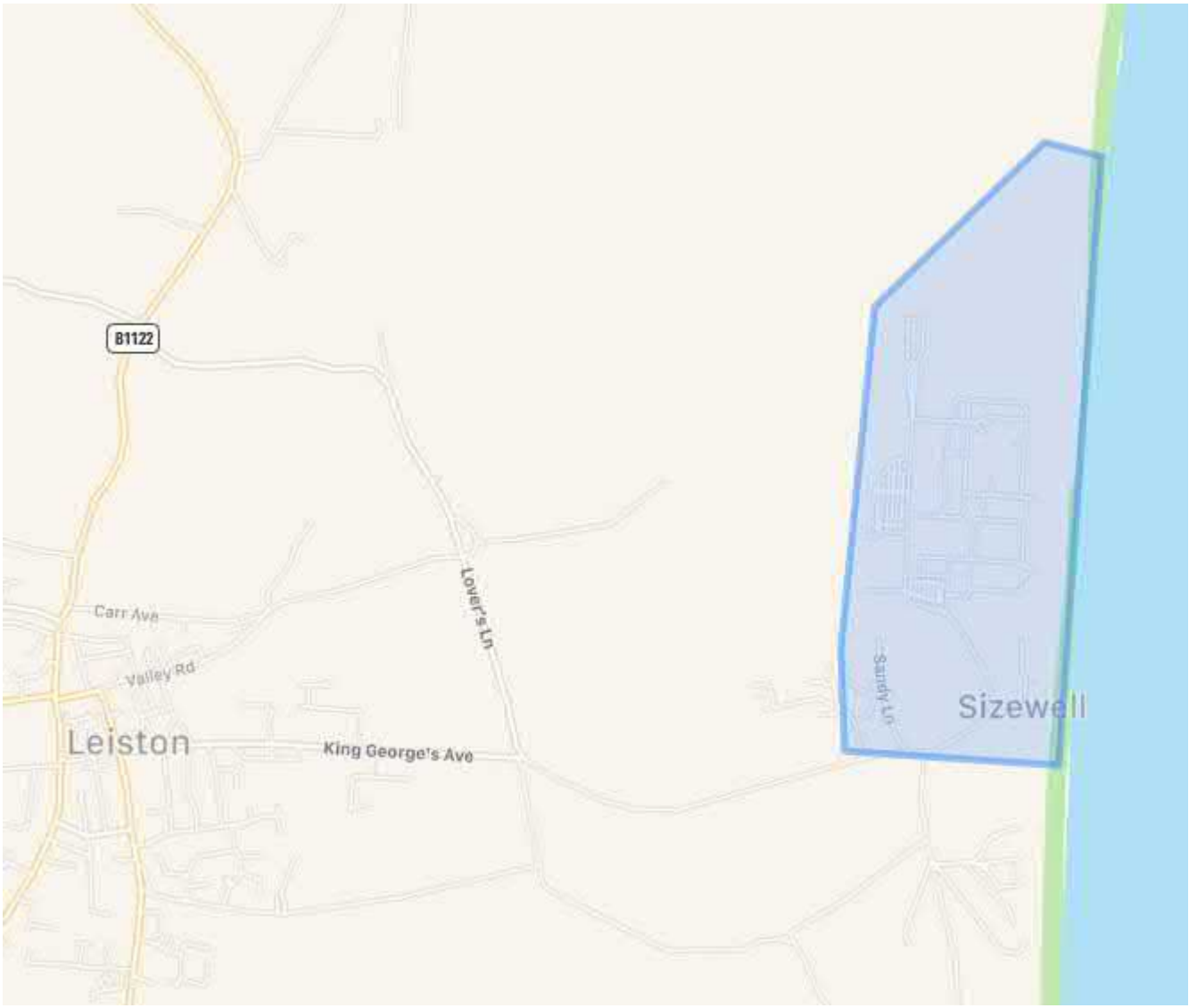
Administration building
Sandy Lane
Leiston Common
Leiston
Suffolk
IP16 4UJ

I include a plan with the area of interest shown in blue.
The grid reference for this area of interest is;

X: 647261
Y: 263638

Should you require any further information to process this request please don't hesitate to contact myself directly.

Kind regards,
[redacted]



[redacted]MSc, BSc (Hons)
Flood Risk Consultant, Water Europe
For and on behalf of Flood Risk Consultancy Team
Water Europe, Royal HaskoningDHV

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creating a better place

Environment Agency

Our ref EAn/2018/109626

Date 10 January 2019

Dear [redacted]

Enquiry regarding Products 4 and 8 for Administration building, Sandy Lane, Leiston Common, Leiston, Suffolk, IP16 4UJ.

Thank you for your enquiry which was received on 7 December 2018.
We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

Abstract

Name	Product 4
Description	Detailed Flood Risk Assessment Map for Administration Building, Sandy Lane, Leiston Common, Leiston, Suffolk, IP16 4UJ.
Licence	Open Government Licence
Information Warnings	None
Information Warning - OS background mapping	The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.
Attribution Contains	Environment Agency information © Environment Agency and/or data-base rights. Contains Ordnance Survey data © Crown copyright 2017 Ordnance Survey 100024198.

East Anglia Area
Ipswich Office, Iceni House, Cobham Road, Ipswich, Suffolk, IP3 9JD
Brampton Office, Bromholme Lane, Brampton, Huntingdon, PE28 4NE
General Enquiries: 03708 506506
Email: enquiries@environment-agency.gov.uk
Website: https://www.gov.uk/government/organisations/environment-agency

Name Product 8	
Description Breach	Hazard Map for Administration Building, Sandy Lane, Leiston Common, Leiston, Suffolk, IP16 4UJ.
Licence	Open Government Licence
Conditions	1.0 You may use the Information for your internal or personal purposes and may only sublicense others to use it if you do so under a written licence which includes the terms of these conditions and the agreement and in particular may not allow any period of use longer than the period licensed to you. 2.0 Notwithstanding the fact that the standard wording of the Environment Agency Conditional Licence indicates that it is perpetual, this Licence has a limited duration of 5 years at the end of which it will terminate automatically without notice. 3.0 We have restricted use of the Information as a result of legal restrictions placed upon us to protect the rights or confidentialities of others. In this instance it is because of sensitive data.
Information Warnings	1.0 This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater, and maximum values of these are also mapped. 2.0 The map is based on computer modelling of simulated breaches at specific locations. Each breach has been modelled individually and the results combined to create this map. Multiple breaches, other combinations of breaches, different sized tidal surges or flood flows may all give different results. 3.0 The map only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. The likelihood of a breach occurring will depend on a number of different factors, including the construction and condition of the defences in the area. A breach is less likely where defences are of a good standard, but a risk of breaching remains. 4.0 Please contact the Environment Agency for further information on emergency planning associated with flood risk in this area.
Information	The mapping of features provided as a background in this product is

Warning - OS background mapping	© Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.
Attribution	Contains Ordnance Survey data © Crown copyright 2017 Ordnance Survey 100024198. Contains Environment Agency information © Environment Agency and/or database rights.

Attribution

Data Available Online
Many of our flood datasets are available online:

- Flood Map For Planning (Flood Zone 2, Flood Zone 3 ,Flood Storage Areas, Flood Defences, Areas Benefiting from Defences)
- Risk of Flooding from Rivers and Sea
- Historic Flood Map
- Current Flood Warnings

What's In Your BackYard (WIYBY) is no longer available.
Most of the data is still available via other sharing services such as DATA.GOV.UK, MAGIC map and new GOV.UK digital services. Where the datasets are no longer available as maps, you will be able to download and use within specialist applications.

To find out all the services the Environment Agency have available, please click here.

For any other enquiries please send your request to us at:

Enquiries_EastAnglia@environment-agency.gov.uk.

Additional information

Please be aware that we now charge for planning advice provided to developers, agents and landowners. If you would like advice to inform a future planning application for this site then please complete our https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion and email it to our Sustainable Places team planning.ipswich@environment-agency.gov.uk. They will initially provide you with a free response identifying the following:

- the environmental constraints affecting the proposal;
- the environmental issues raised by the proposal;
- the information we need for the subsequent planning application to address the issues identified and demonstrate an acceptable development;
- any required environmental permits.

If you require any further information from them (for example, a meeting or the detailed review of a technical document) they will need to set up a charging agreement. Further information can be found on our website.

Please note we have published revised climate change allowances, which are available online. These new allowances will need to be reflected in your Flood Risk Assessment. If you want to discuss this please call our Sustainable Places team on 0203 025 5475.

TEAM2100: delivering the first 10 years of investment in tidal flood defences for the Thames Estuary 2100 Plan. For more information, visit the TEAM2100 website or email team2100@jacobs.com

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Yours sincerely

[redacted]

Customers and Engagement Officer

Direct dial: [redacted]

East Anglia Area
Ipswich Office, Iceni House, Cobham Road, Ipswich, Suffolk, IP3 9JD
Brampton Office, Bromholme Lane, Brampton, Huntingdon, PE28 4NE
General Enquiries: 03708 506506
Email: enquiries@environment-agency.gov.uk
Website: https://www.gov.uk/government/organisations/environment-agency

Reference: **EAn/2018/109626**
Site Address: **Administartion building, Dany Lane, Leiston Common, Leiston, Suffolk, IP16 4UJ**
Date: **21/12/2018**

Included:

- Flood Map

Middleton & Sizewell Study 2013

- Undefended Key Outlines – Current Day
- Undefended Key Outlines – Climate Change
- 1D Nodes Map & Table

Leiston Coastal 2018

- Defended Key Outlines – Current Day
- Defended Key Outlines – Climate Change
- Undefended Key Outlines – Current Day
- Undefended Key Outlines – Climate Change
- 2D Nodes Map & Table

Important information to note with your Product:

Flood Risk Assessments (FRAs)
If you are obtaining this information for use within a Flood Risk Assessment (FRA) required for a planning application, please include our unaltered Product 4 data within an appendix of your FRA.

Flood Zones
Please see the attached map showing the Flood Zones (outlines) for the area of the site. Our maps show the site is located in fluvial and tidal Flood Zone 1, 2 and 3. For further information with regards to Flood Zones, please see below:

Table 1: Flood Zones

These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.(Land shown in dark blue on the Flood Map)

Paragraph: 065 Reference ID: 7-065-20140306

New Coastal Modelling (2018)
The flood zones derived from this model will not show on our external website until our next publication date of Thursday 31st January 2019.

Climate Change (Fluvial Only)
Flood risk data requests including an allowance for climate change will be based on the 1% annual probability flood including an additional 20% increase on peak flows to account for climate change impacts, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

The flow data for this model has been provided.

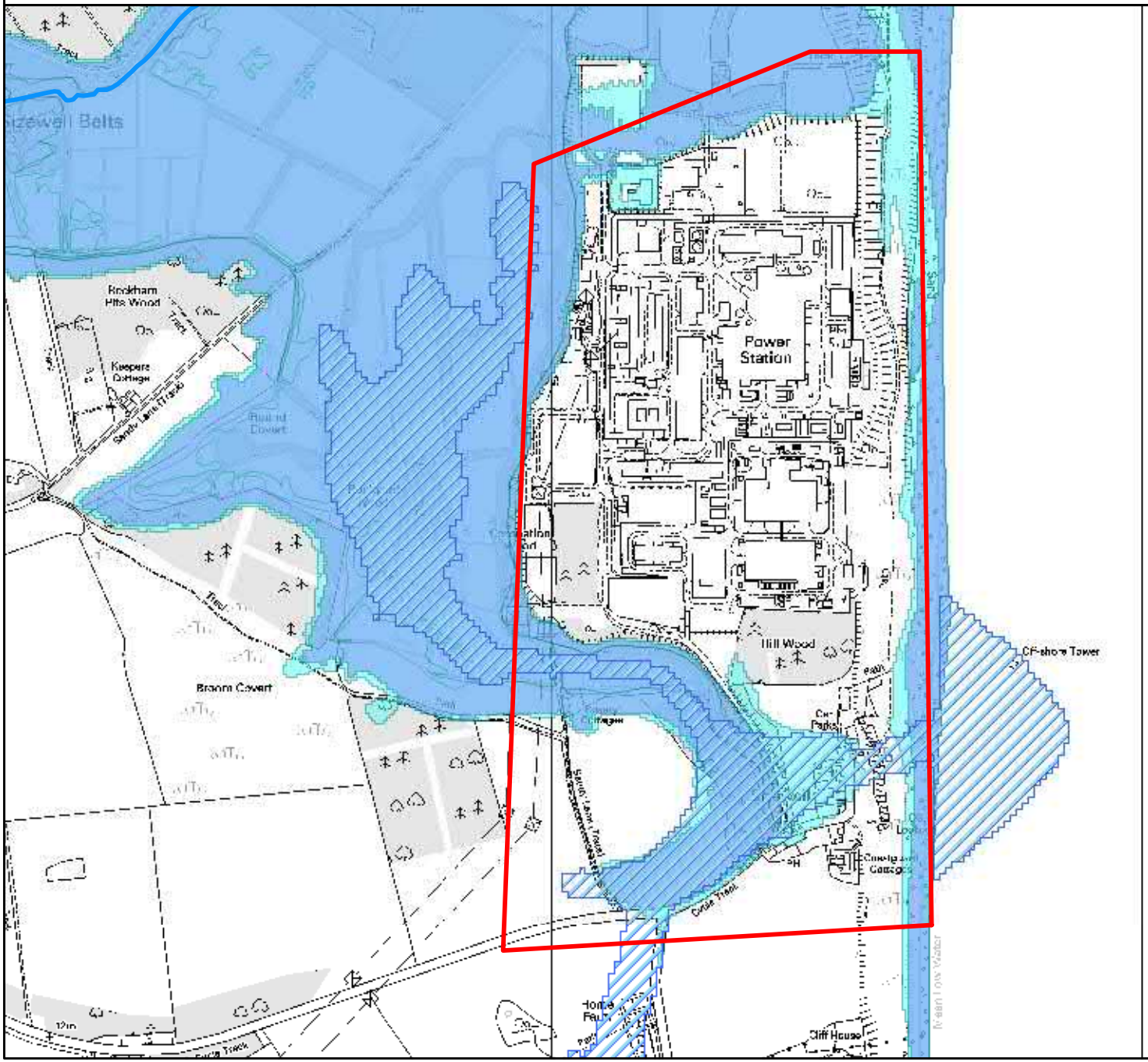
For further guidance on fluvial climate change please contact the Partnership and Strategic Overview Team at: PSOENS@environment-agency.gov.uk

Historic Flood Events
We have checked our historic flooding database and have found no record of flooding in this area. This does not mean that the site has never flooded, only that no flooding has been reported to us in this location.

Surface Water
Please be aware that in recent years, there has been an increase in flood damage caused by surface water flooding or drainage systems that have been overwhelmed. We have worked with Lead local Flood Authorities (LLFAs) to develop a map which incorporates the best local and national scale information on surface water flood risk. These maps can be viewed on our website at the following:-
https://flood-warning-information.service.gov.uk/long-term-flood-risk/

Reservoir Flooding
You can obtain a map which shows the extent of flooding if a reservoir was to fail and release the water that it holds. The map shows the worst case scenario. These maps can be viewed on our website at the following:-
https://flood-warning-information.service.gov.uk/long-term-flood-risk/

Flood Map For Planning



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 120 240 480

Metres

1:10,000

Legend

- Main Rivers
- Site Location
- Outline_Reservoir_Flood_Maps
- Flood Zone 3
- Flood Zone 2

Flood Map for Planning (assuming no defences)

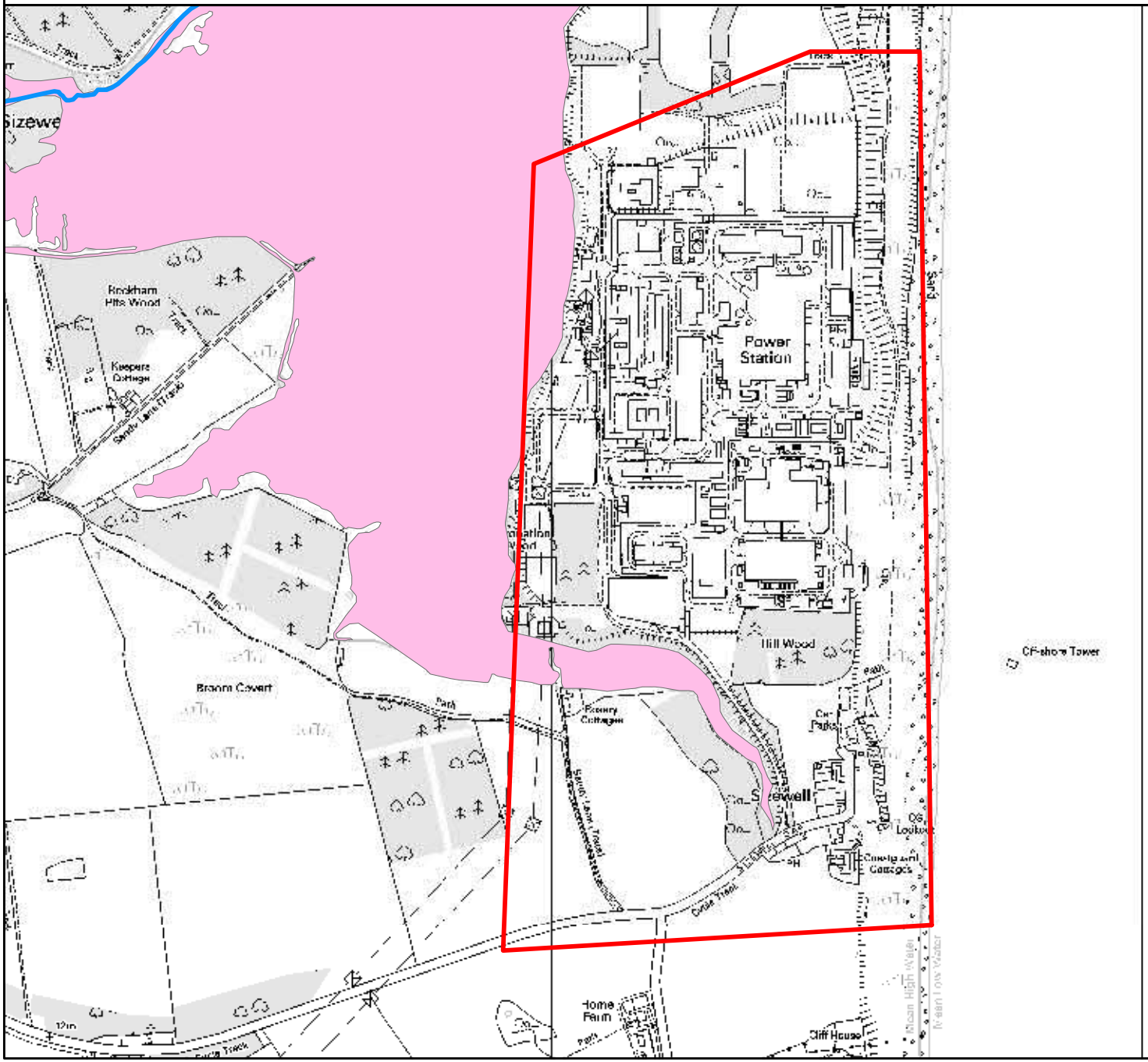
Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Produced by: Partnership & Strategic Overview
East Anglia: Essex, Norfolk & Suffolk

Modelled Climate Change Outlines Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 120 240 480

Metres

1:10,000

Legend

- Main Rivers
- Site Location
- 1 in 100+20% (*CC)

This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

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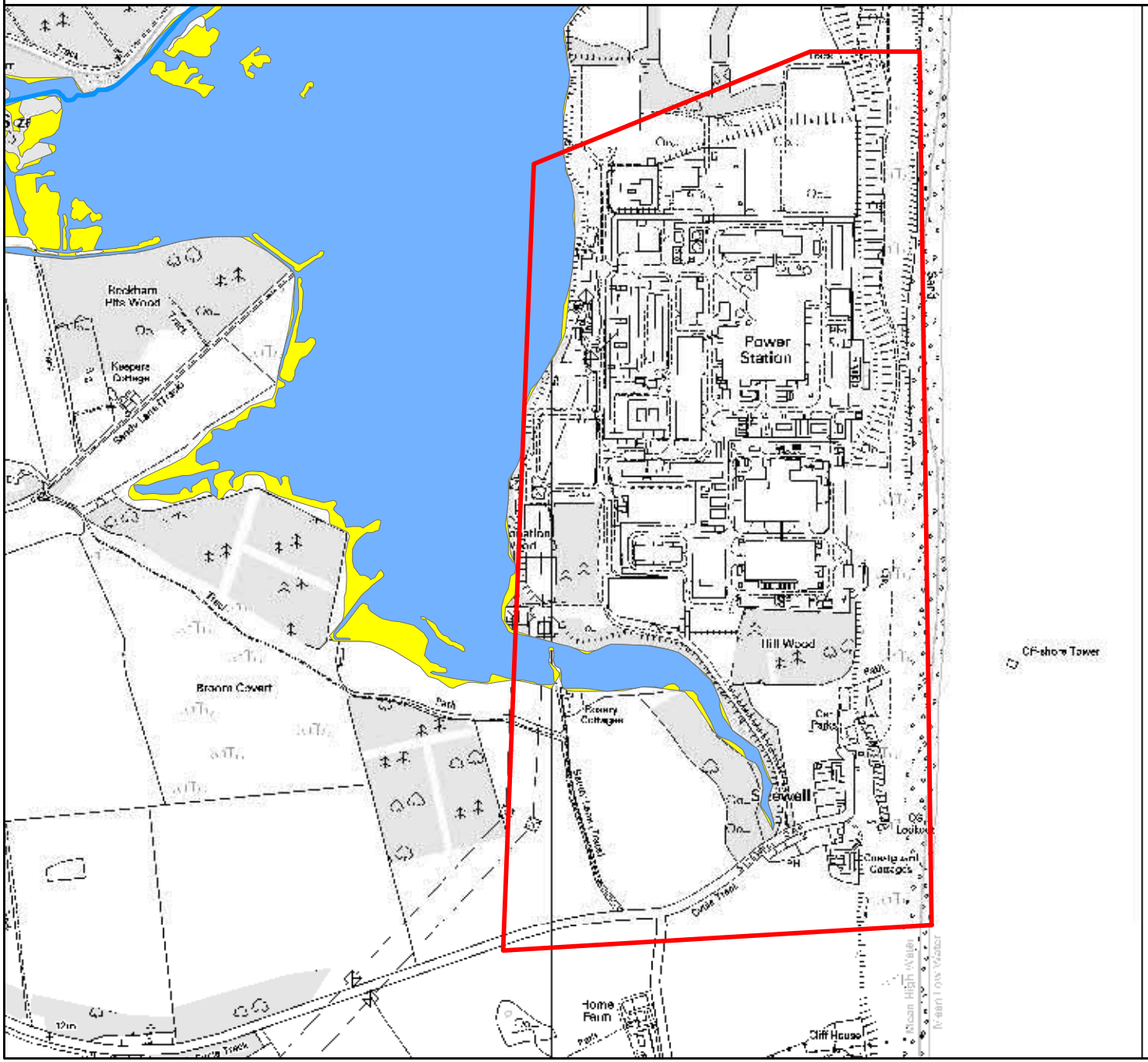
Produced by: Partnership & Strategic Overview
East Anglia: Essex, Norfolk & Suffolk

Modelled Outlines Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 120 240 480

Metres

1:10,000

Legend

- Main Rivers
- Site Location
- 1 in 100 (1%)
- 1 in 1000 (0.1%)

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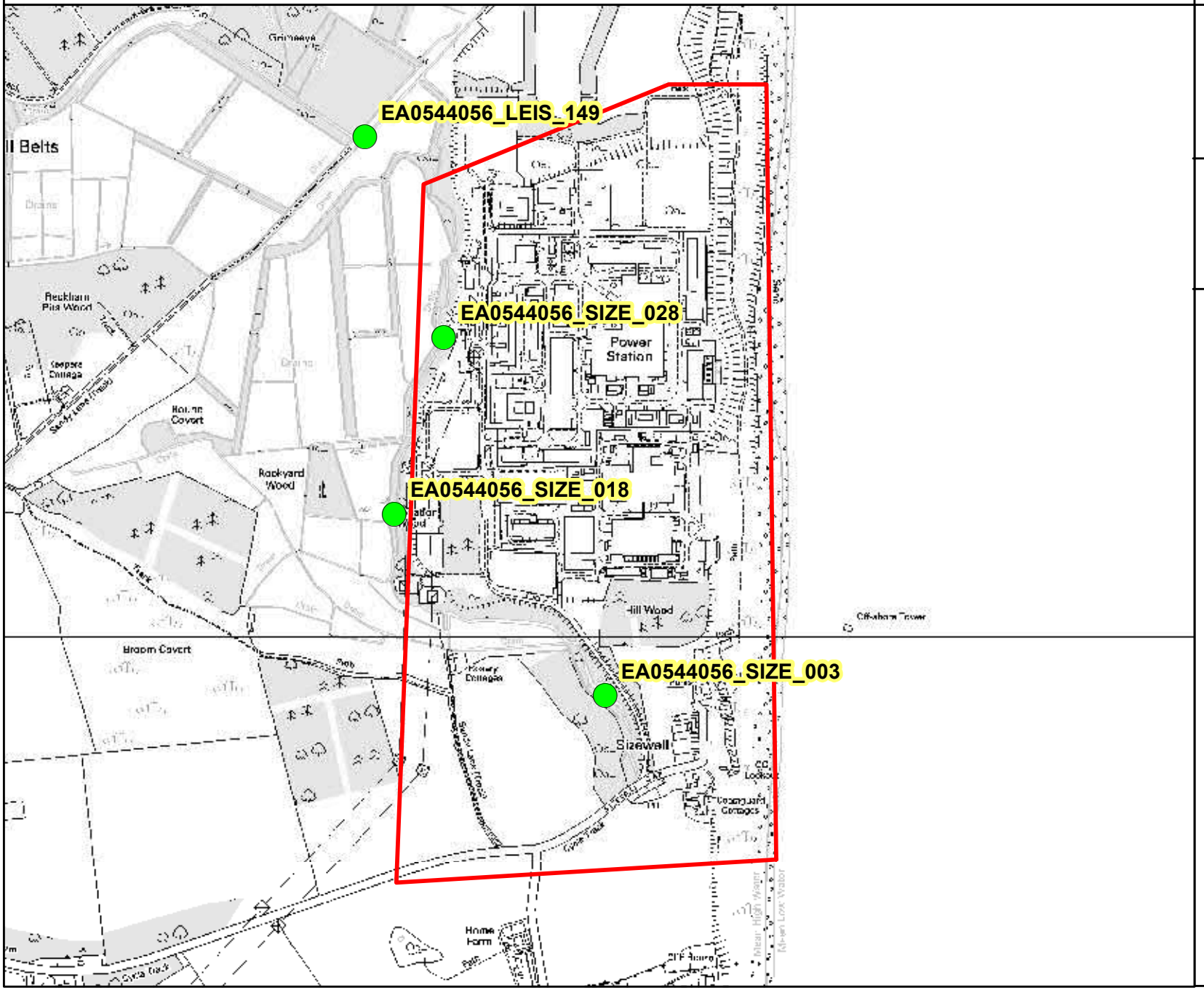
Produced by: Partnership & Strategic Overview
East Anglia: Essex, Norfolk & Suffolk

Modelled Levels & Flows Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500

Metres

1:10,500

Legend

- Sizewell Levels & Flows
- Site Location

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Produced by: Partnership & Strategic Overview
East Anglia: Essex, Norfolk & Suffolk

Datasheet Reference:	**EAn/2018/109629**
Source of information:	**Middleton & Sizewell Study 2013**
Produced By	**JBA Consulting**
Source of Flooding	**Fluvial**
Flood Levels Provided	**In-Channel**

Key	
CC	**Climate Change**
AEP	**Annual Exceedance Probability**
mAODN	**Metres Above Ordnance Datum Newlyn**
m^3s^{-1}	**Cubic Metres Per Second (Cumecs)**

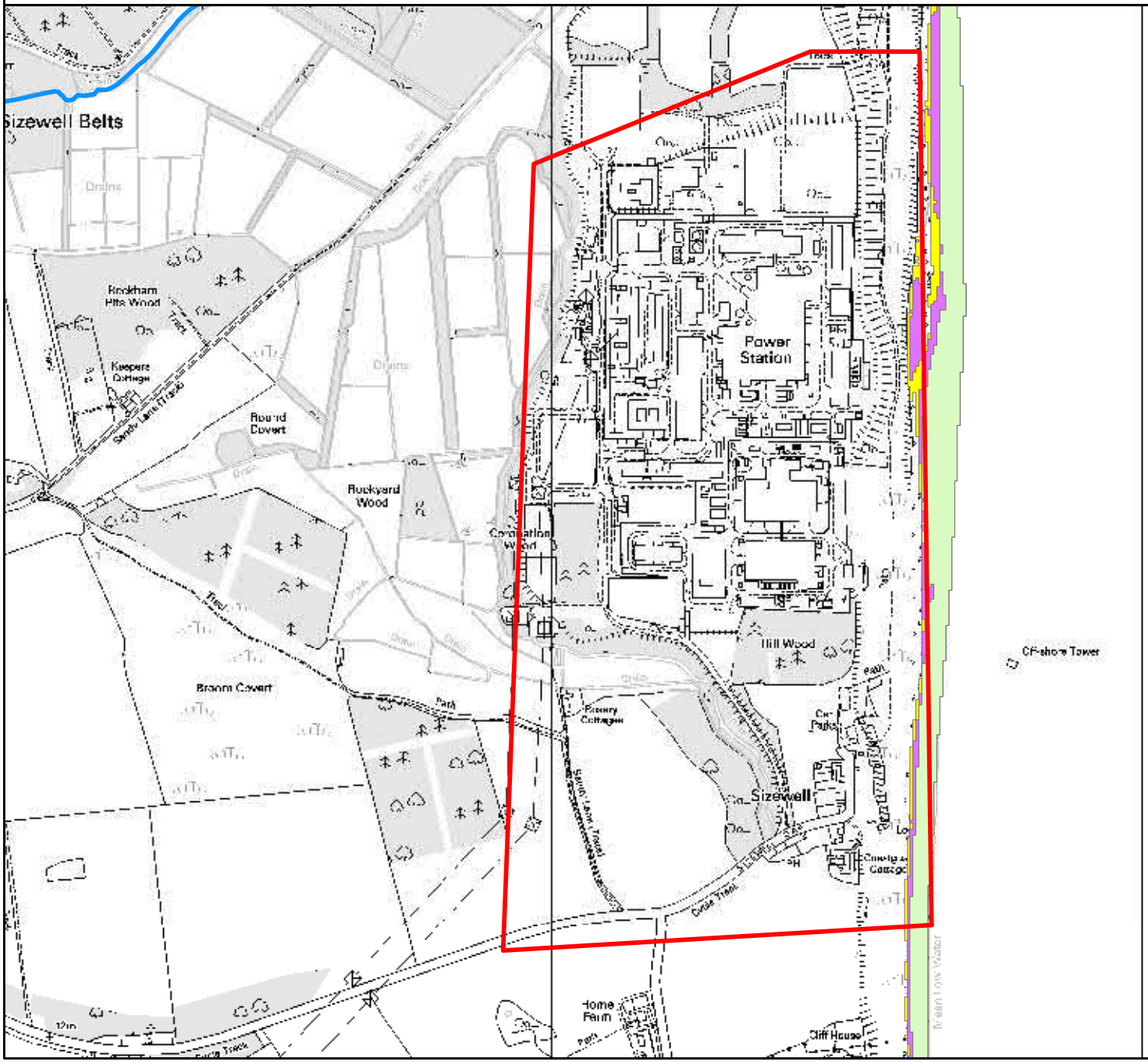
Undefended
Levels (mAODN) **AEP**

Node	Eastings	Northings	4% (1:25)	2% (1:50)	1.33% (1:75)	1% (1:100)	1% (1:100) +20%CC	0.1% (1:1,000)
EA0544056_LEIS_149	646858	263953	0.61	0.75	0.88	0.95	1.01	1.12
EA0544056_SIZE_003	647316	262887	0.61	0.75	0.88	0.95	1.01	1.12
EA0544056_SIZE_018	646914	263233	0.61	0.75	0.88	0.95	1.01	1.12
EA0544056_SIZE_028	647009	263570	0.61	0.75	0.88	0.95	1.01	1.12

Undefended
Flows (m^3s^{-1}) **AEP**

Node	Eastings	Northings	4% (1:25)	2% (1:50)	1.33% (1:75)	1% (1:100)	1% (1:100) +20%CC	0.1% (1:1,000)
EA0544056_LEIS_149	646858	263953	0.36	0.43	0.47	0.50	0.54	0.79
EA0544056_SIZE_003	647316	262887	0.12	0.17	0.21	0.25	0.30	0.86
EA0544056_SIZE_018	646914	263233	0.15	0.19	0.24	0.26	0.28	0.67
EA0544056_SIZE_028	647009	263570	0.15	0.21	0.25	0.27	0.26	0.56

Modelled Defended Outlines Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 120 240 480

Metres

1:10,000

Legend

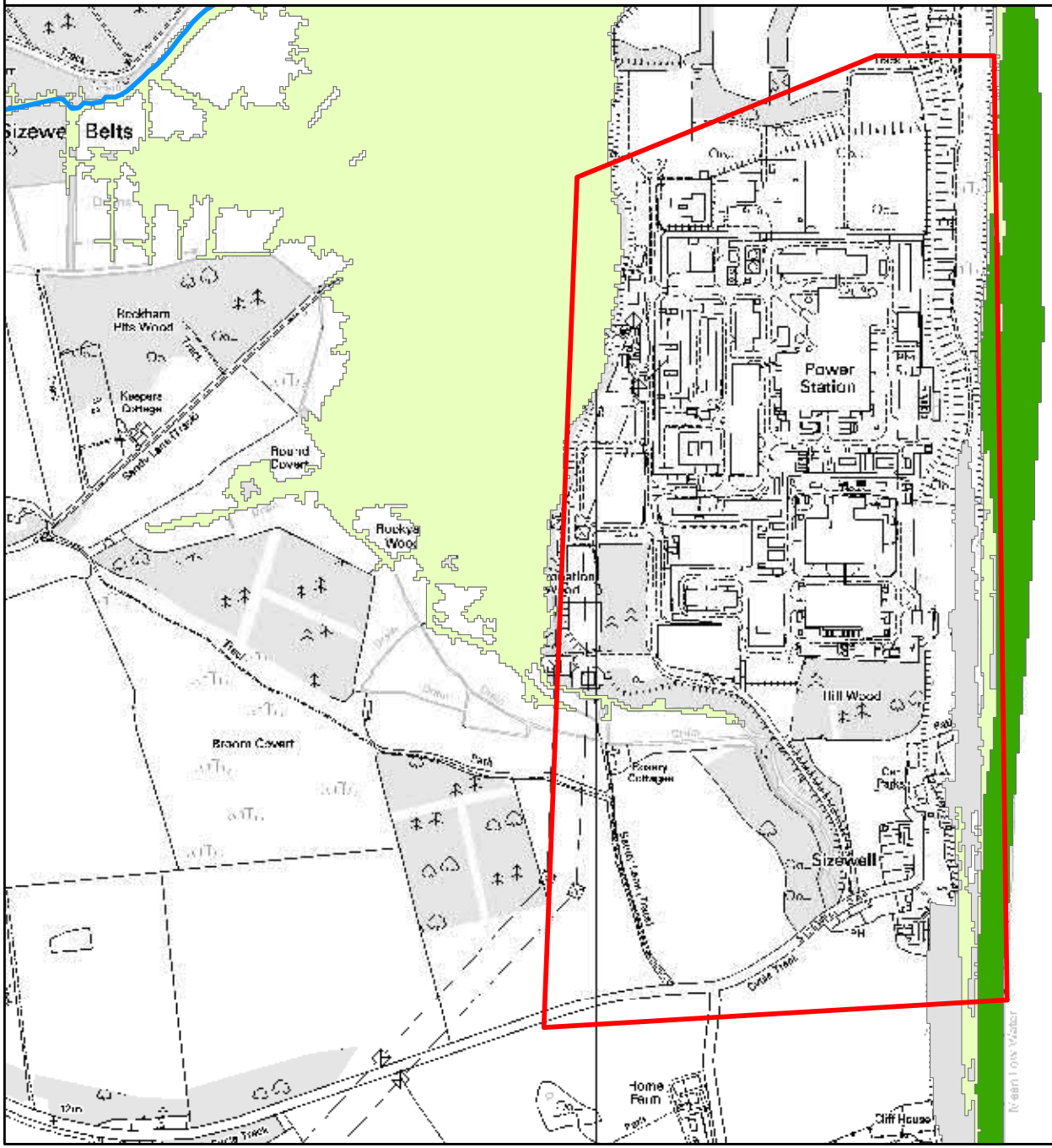
- Main Rivers
- Site Location
- 1 in 20 (5%)
- 1 in 200 (0.5%)
- 1 in 1000 (0.1%)

This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Produced by: Partnership & Strategic Overview
East Anglia: Essex, Norfolk & Suffolk

Modelled Defended Climate Change Outlines Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 120 240 480

Metres

1:10,000

Legend

- Main Rivers
- Site Location
- 1 in 20 (+CC)
- 1 in 200 (+CC)
- 1 in 1000 (+CC)

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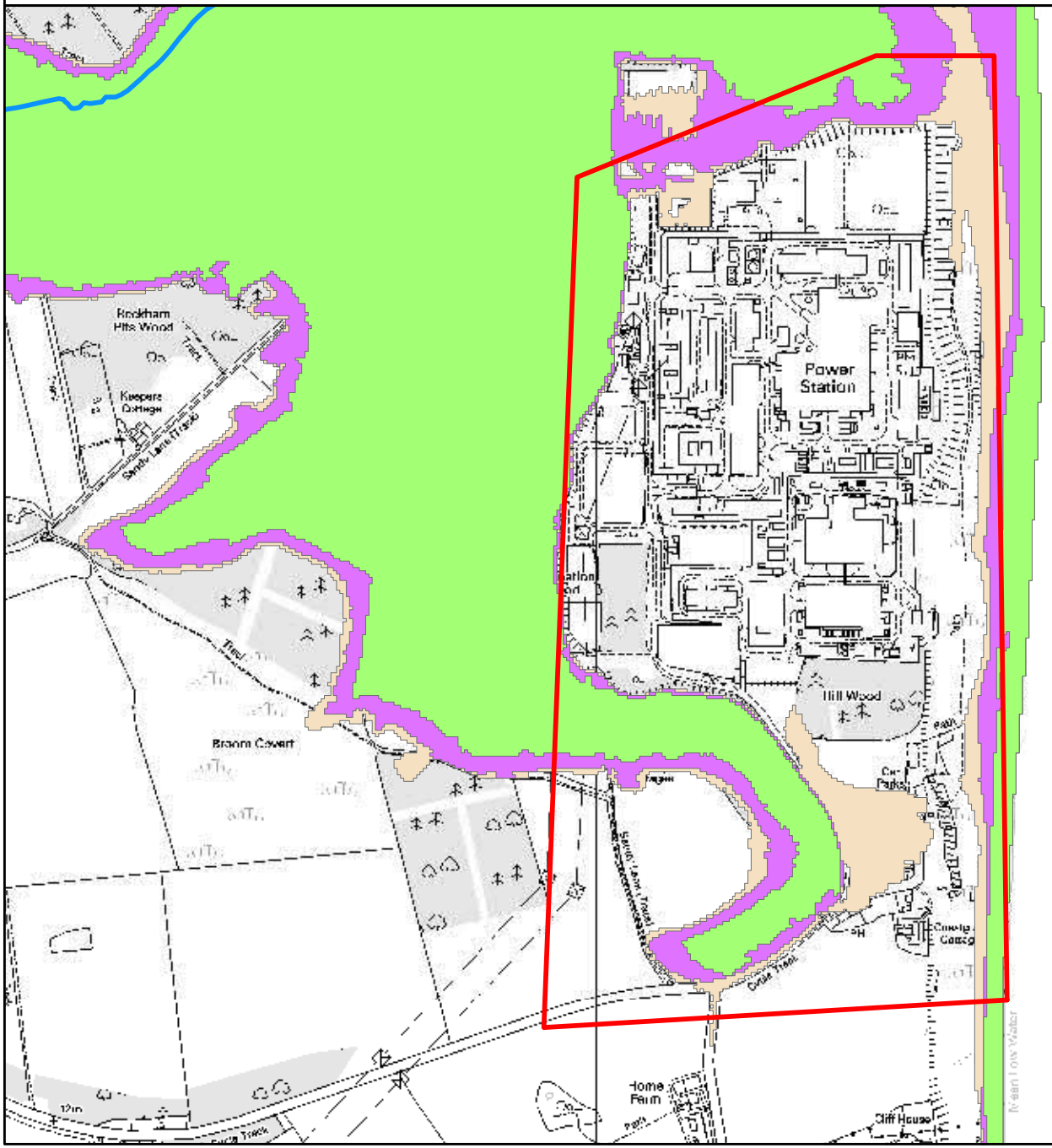
Produced by: Partnership & Strategic Overview
East Anglia: Essex, Norfolk & Suffolk

Modelled Undefended Outlines Location Map



Environment Agency
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Suffolk
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N

0 120 240 480

Metres

1:10,000

Legend

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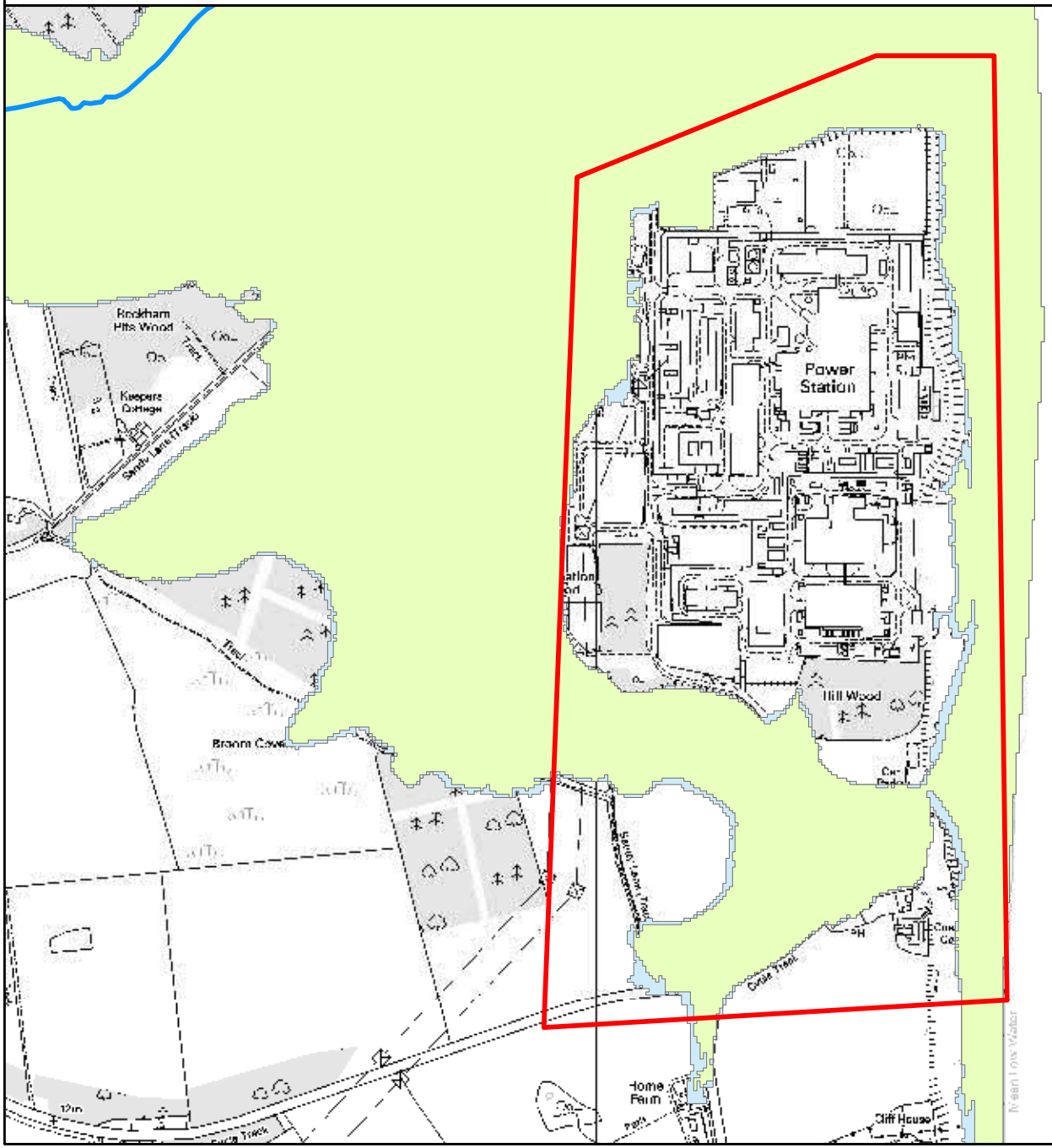
East Anglia: Essex, Norfolk & Suffolk

Modelled Undefended Climate Change Outlines Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 120 240 480

Metres

1:10,000

Legend

- Site Location
- Main Rivers
- 1 in 200 (+CC)
- 1 in 1000 (+CC)

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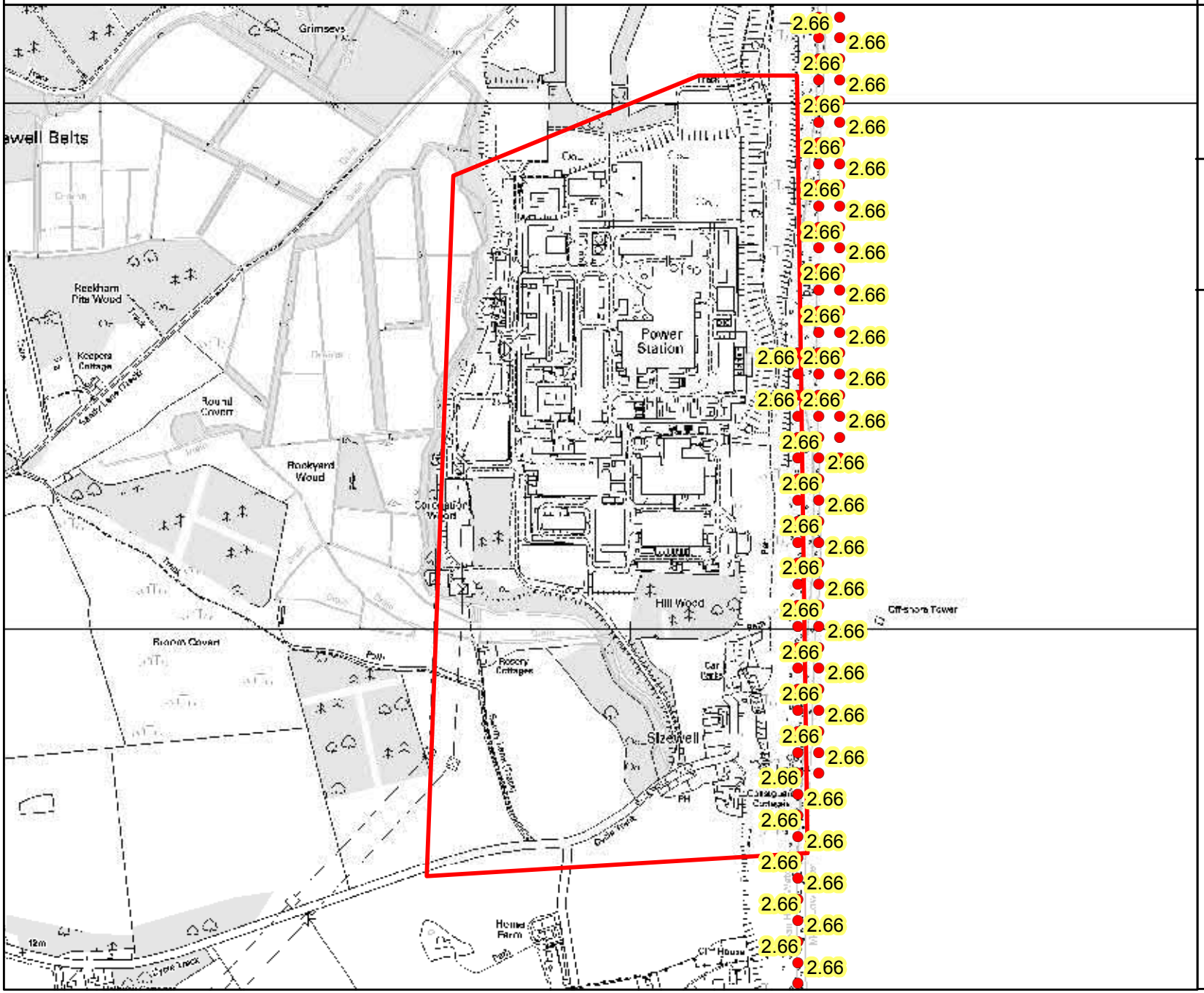
Produced by: Partnership & Strategic Overview
East Anglia: Essex, Norfolk & Suffolk

Modelled Defended Levels Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500

Metres

1:10,500

Legend

Site Location

1 in 20 (5%)

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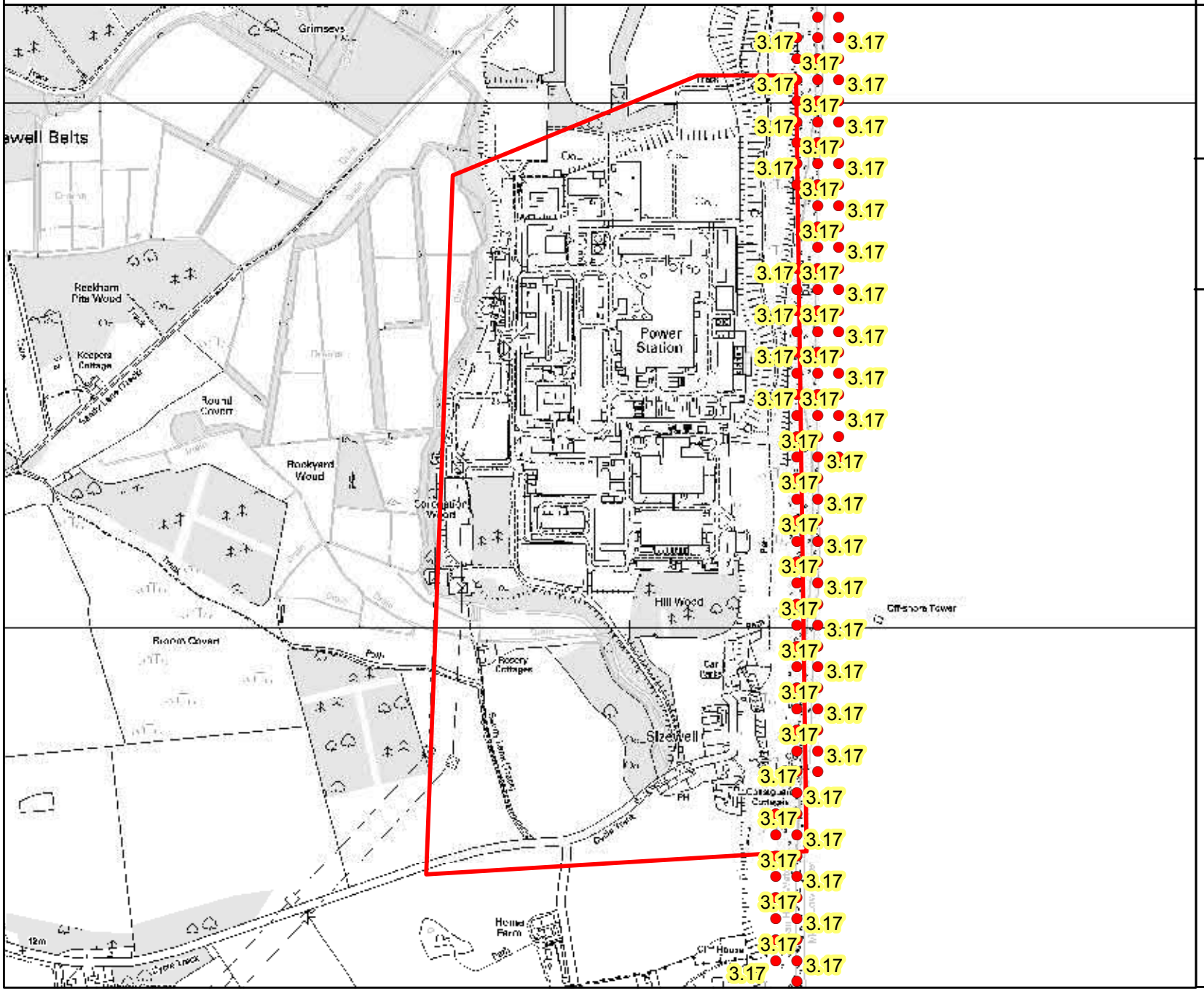
East Anglia: Essex, Norfolk & Suffolk

Modelled Defended Levels Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500

Metres

1:10,500

Legend

Site Location

1 in 200 (0.5%)

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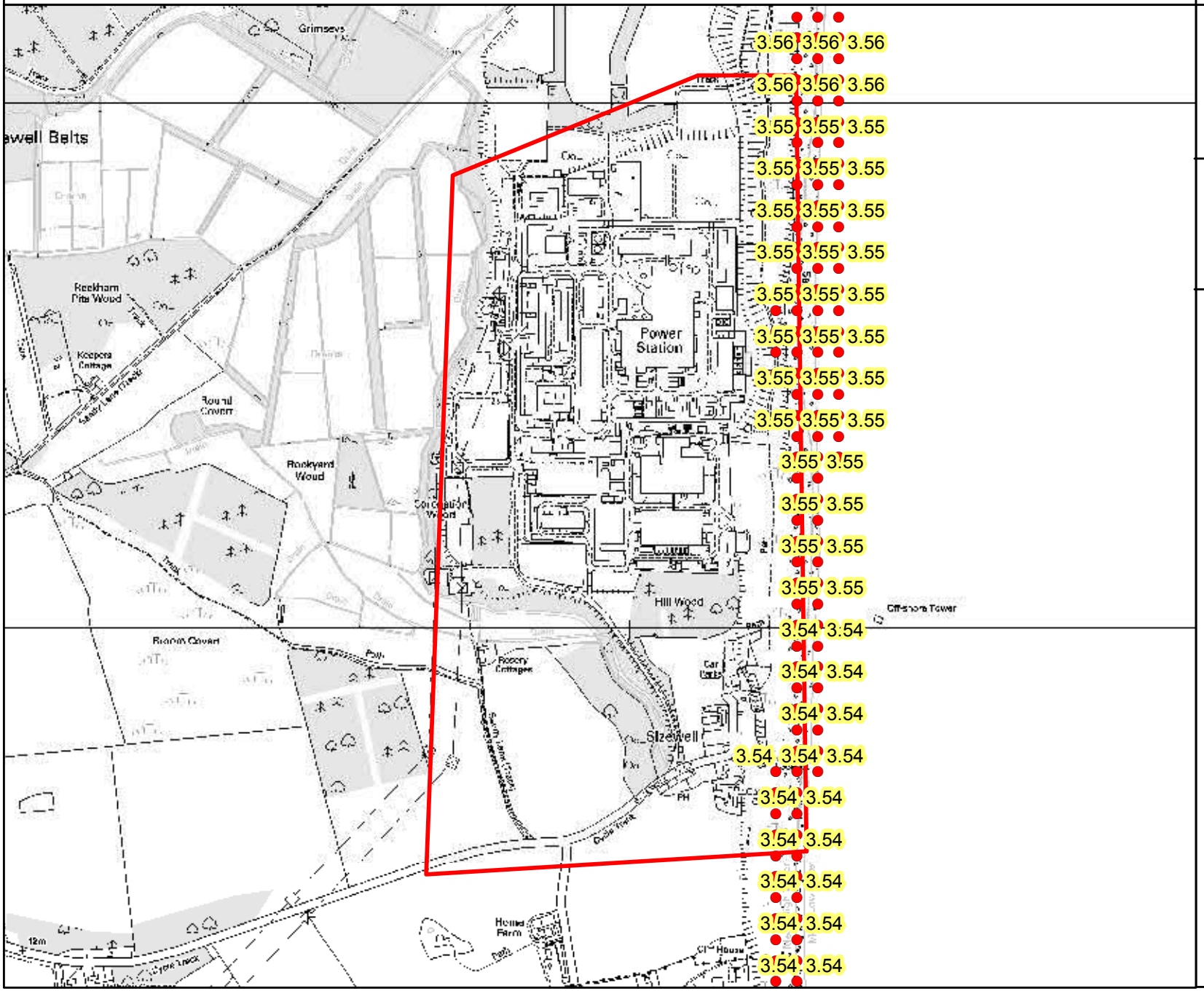
East Anglia: Essex, Norfolk & Suffolk

Modelled Defended Levels Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500
Metres

1:10,500

Legend

Site Location

1 in 1000 (0.1%)

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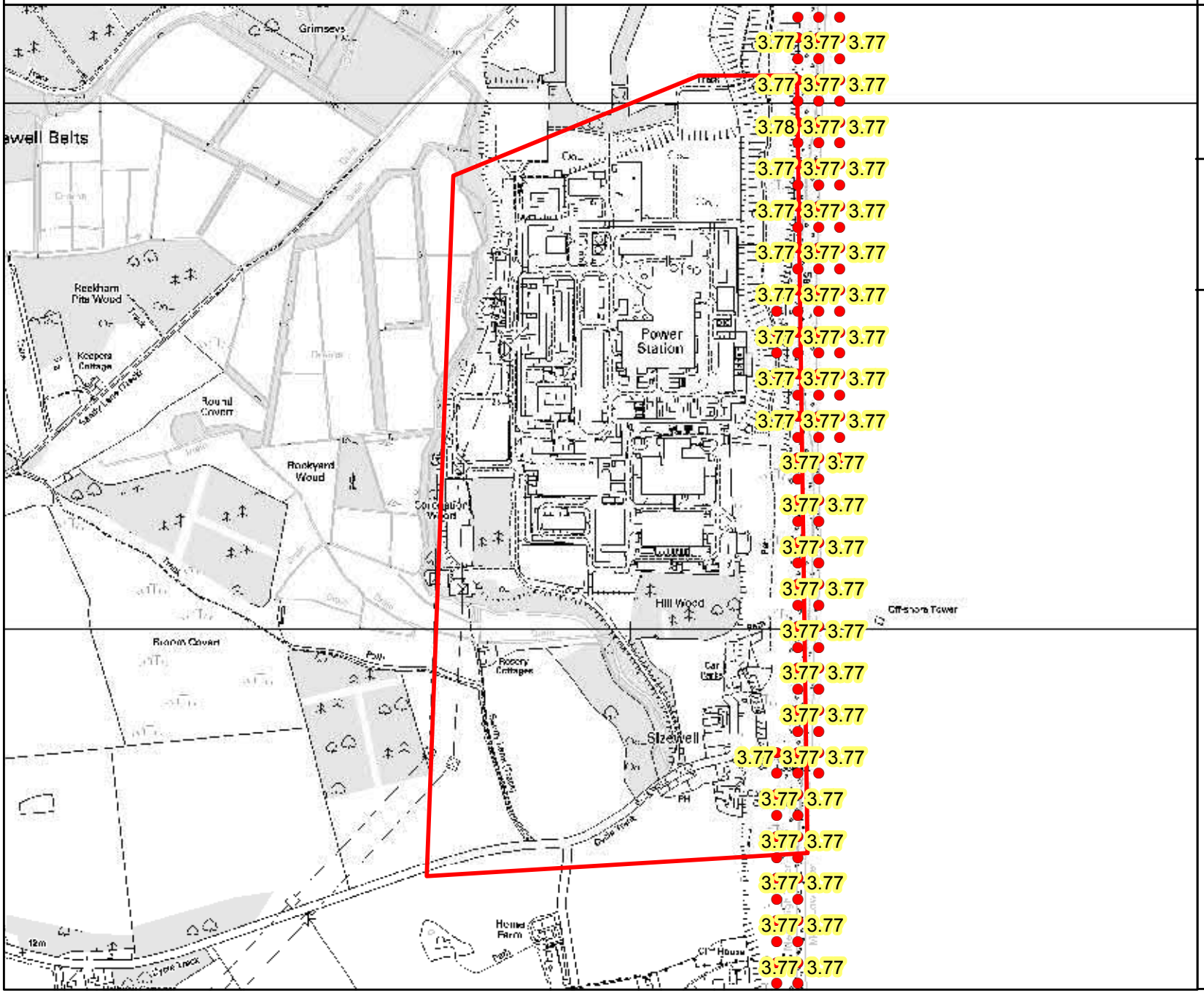
Produced by: Partnership & Strategic Overview
East Anglia: Essex, Norfolk & Suffolk

Modelled Defended Climate Change Levels Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500

Metres

1:10,500

Legend

Site Location

1 in 20 (+CC)

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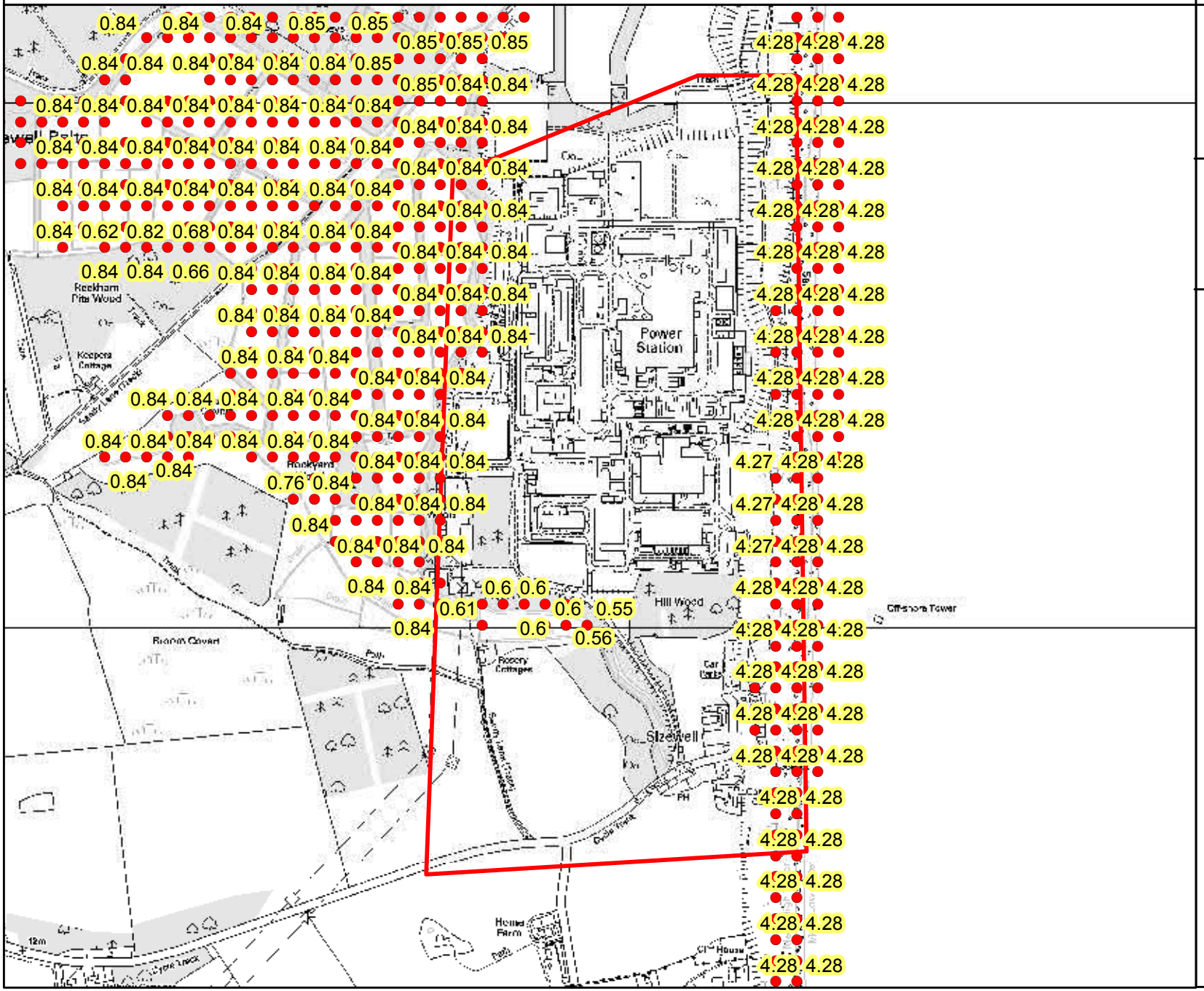
Produced by: Partnership & Strategic Overview
East Anglia: Essex, Norfolk & Suffolk

Modelled Defended Climate Change Levels Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500

Metres

1:10,500

Legend

Site Location

1 in 200 (+CC)

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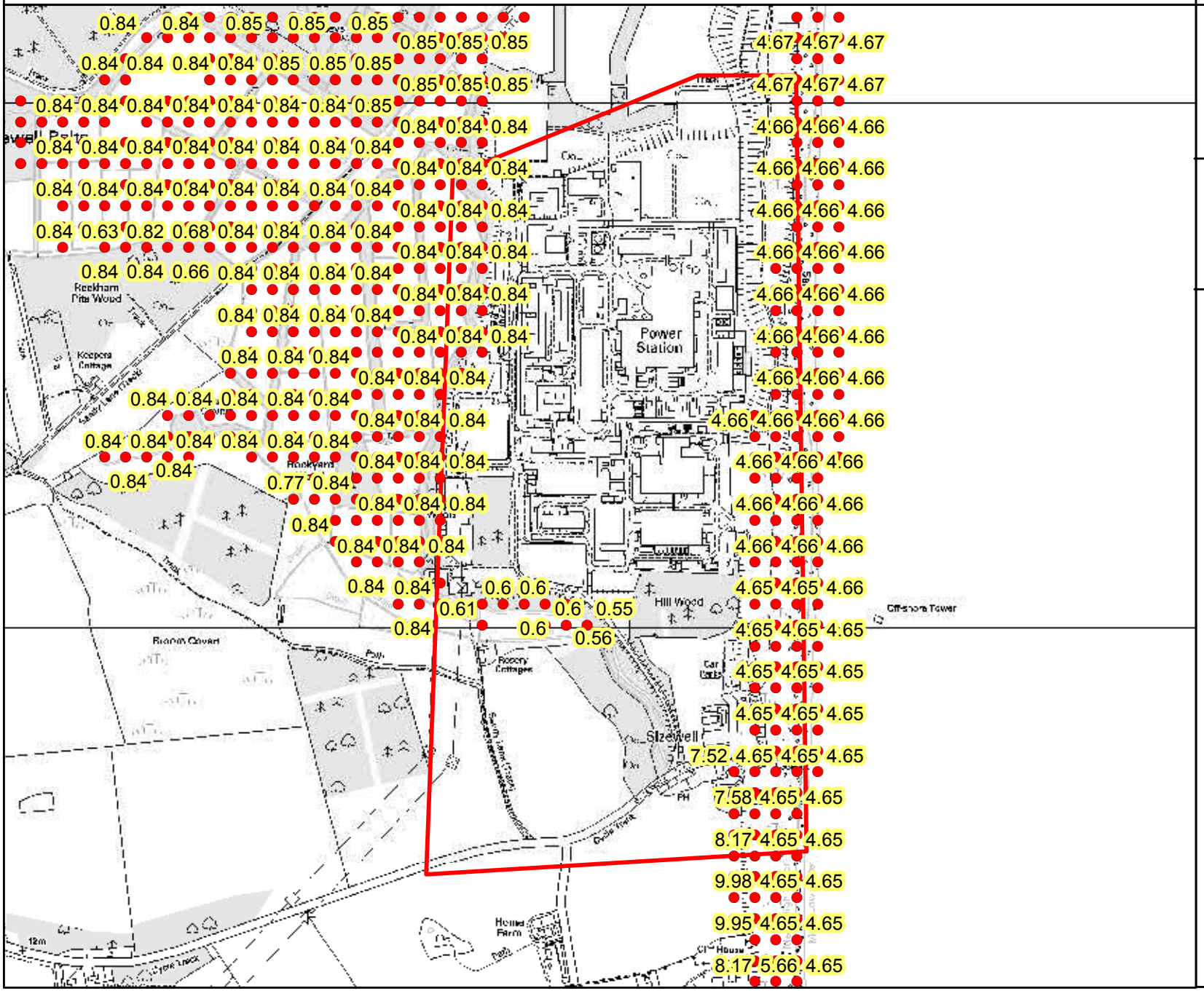
East Anglia: Essex, Norfolk & Suffolk

Modelled Defended Climate Change Levels Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500

Metres

1:10,500

Legend

Site Location

1 in 1000 (+CC)

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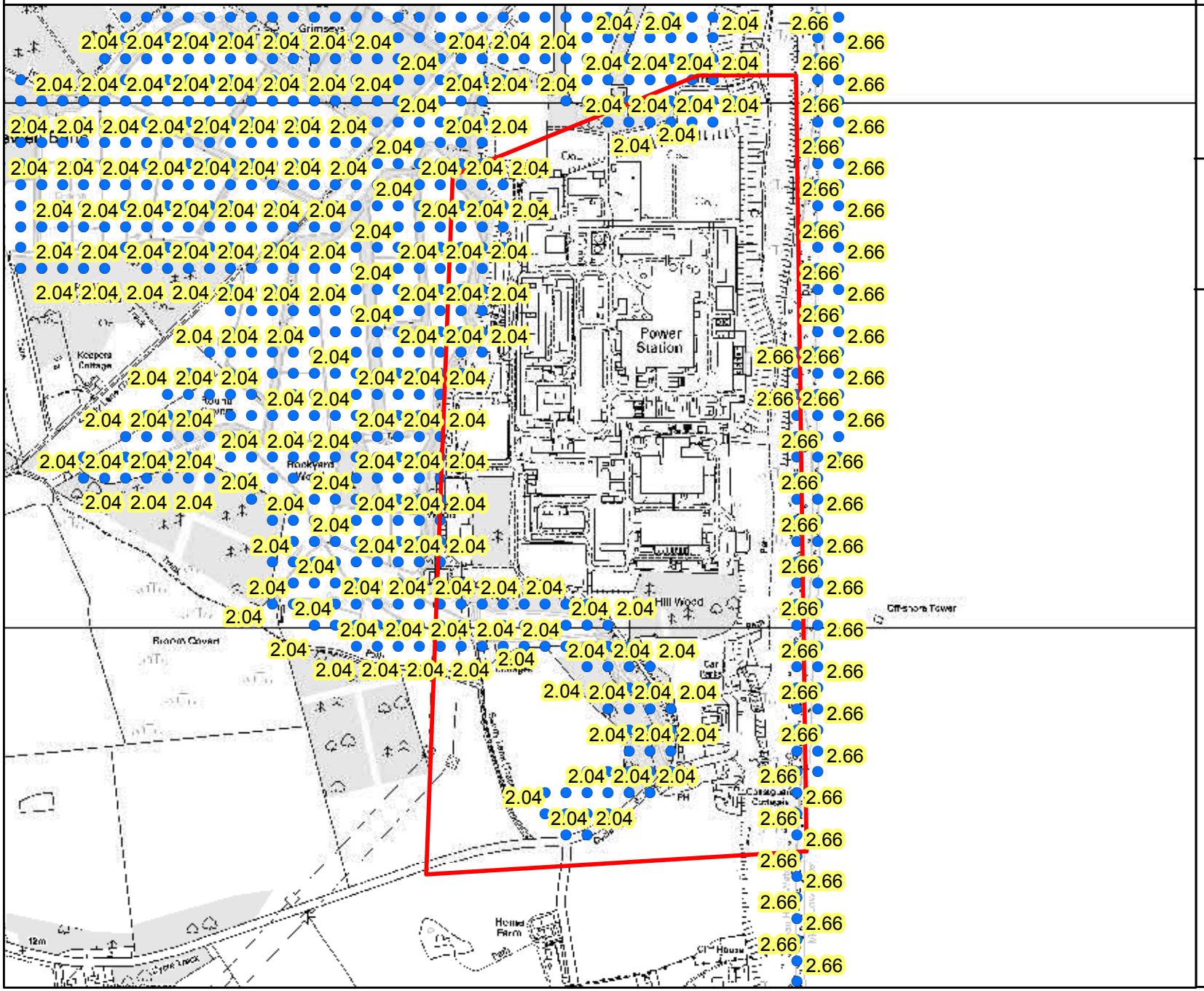
Produced by: Partnership & Strategic Overview
East Anglia: Essex, Norfolk & Suffolk

Modelled Undefended Levels Location Map



Environment Agency

Environment Agency
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Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500

Metres

1:10,500

Legend

Site Location

1 in 20 (5%)

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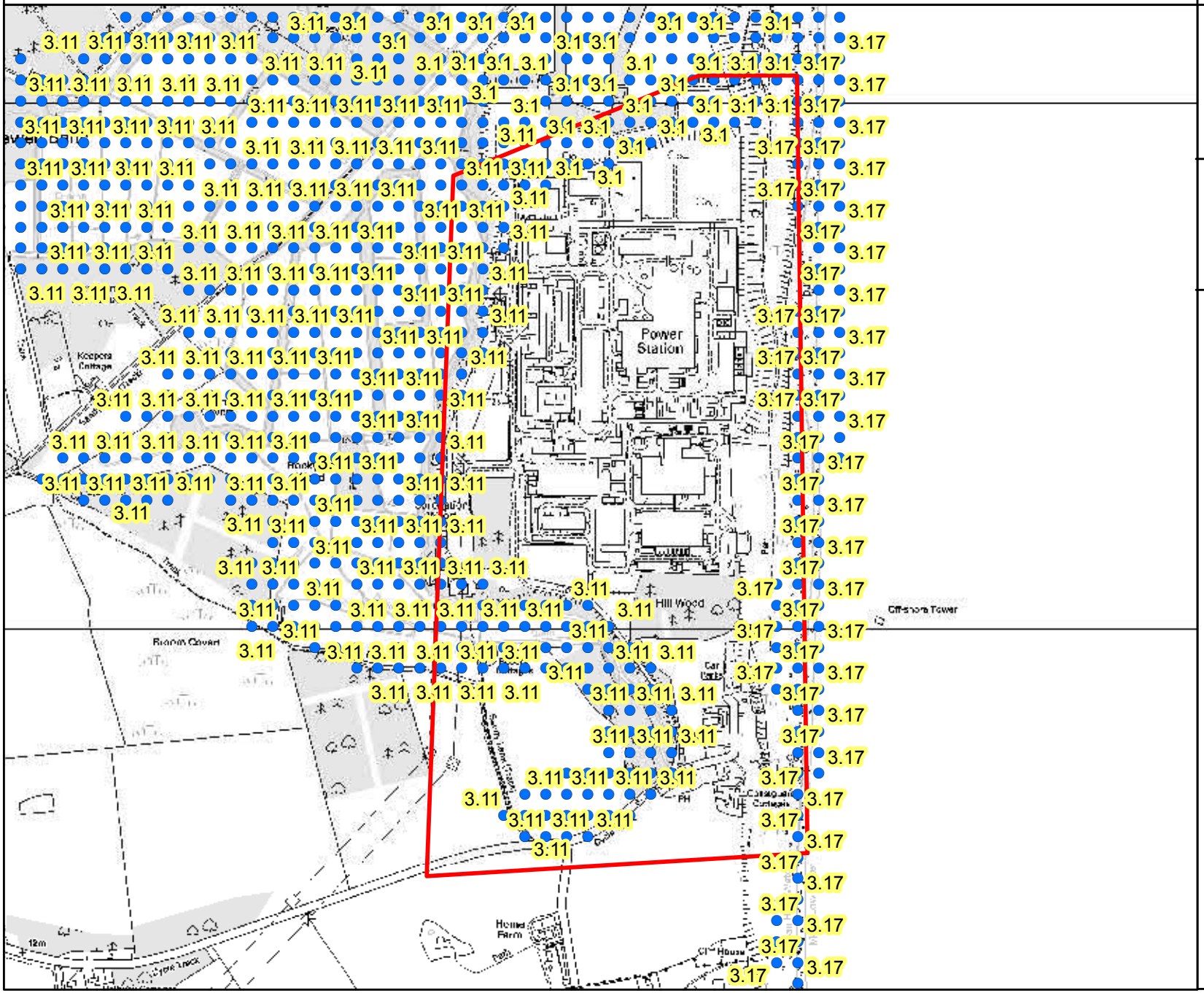
Produced by: Partnership & Strategic Overview
East Anglia: Essex, Norfolk & Suffolk

Modelled Undefended Levels Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500
Metres

1:10,500

Legend

Site Location

1 in 200 (0.5%)

This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

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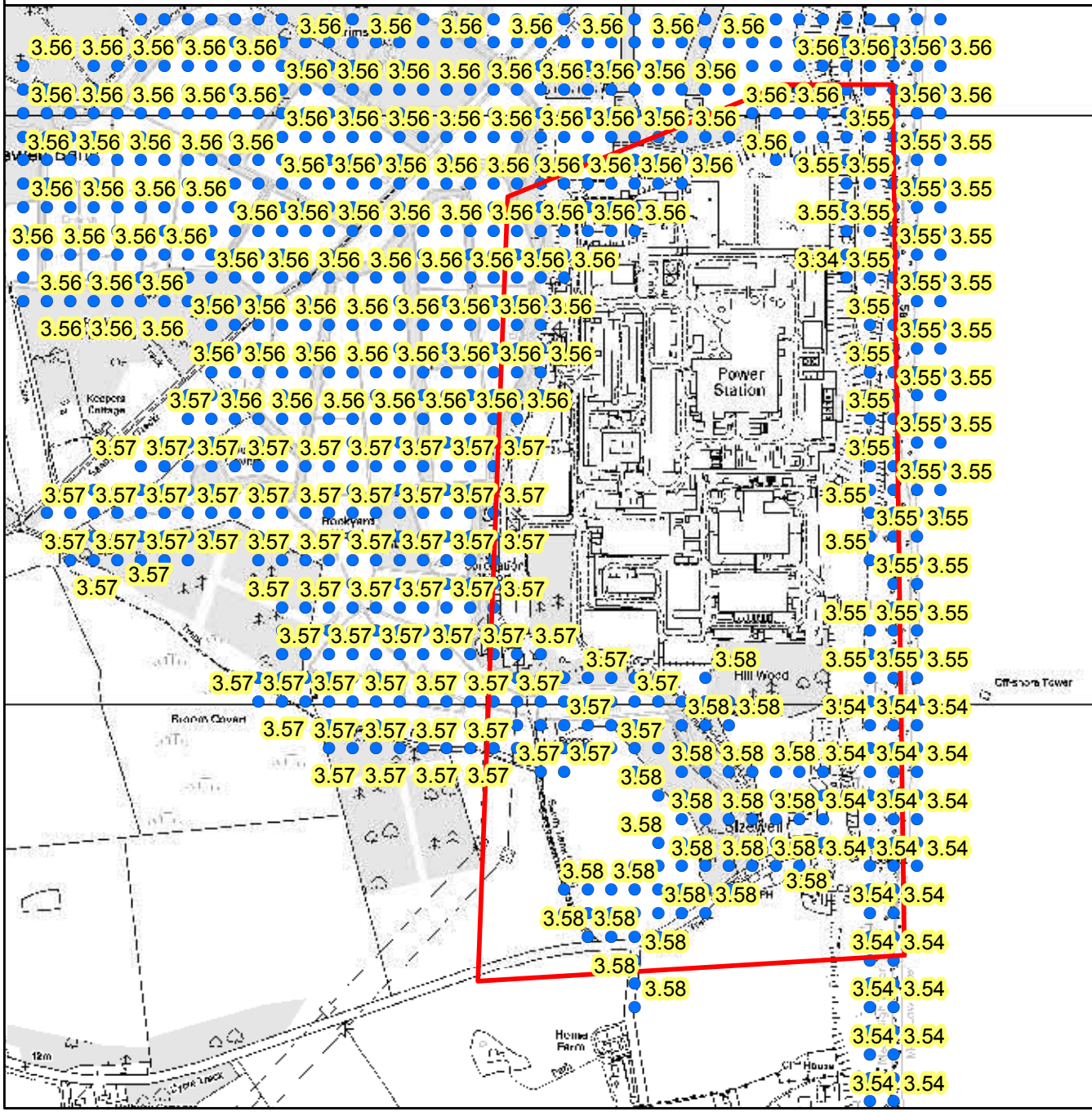
Produced by: Partnership & Strategic Overview
East Anglia: Essex, Norfolk & Suffolk

Modelled Undefended Levels Location Map



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500

Metres

1:10,500

Legend

Site Location

1 in 1000 (0.1%)

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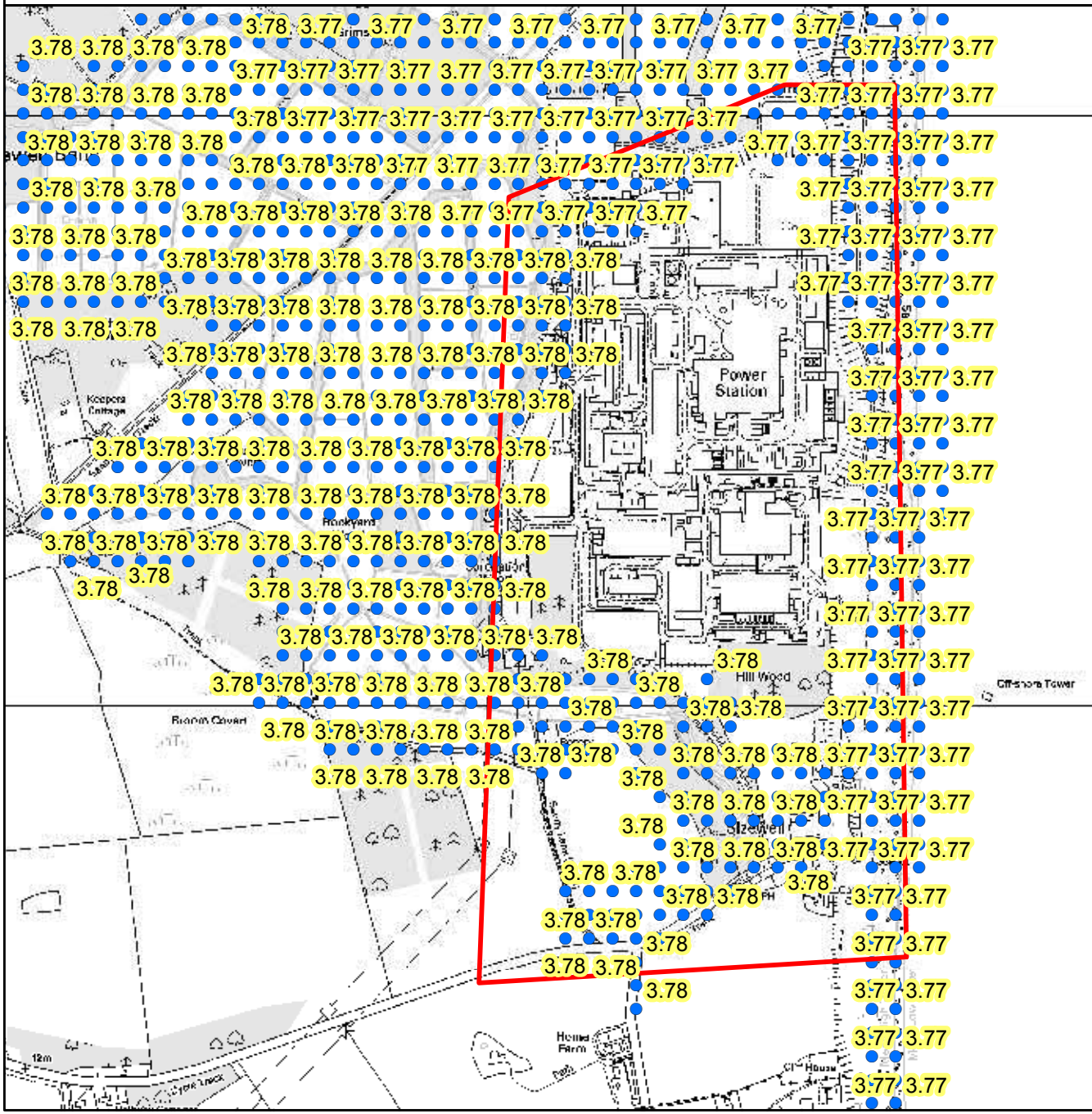
Modelled Undefended Climate Change Levels Location Map



Environment Agency

Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500
Metres

1:10,500

Legend

Site Location

1 in 20 (+CC)

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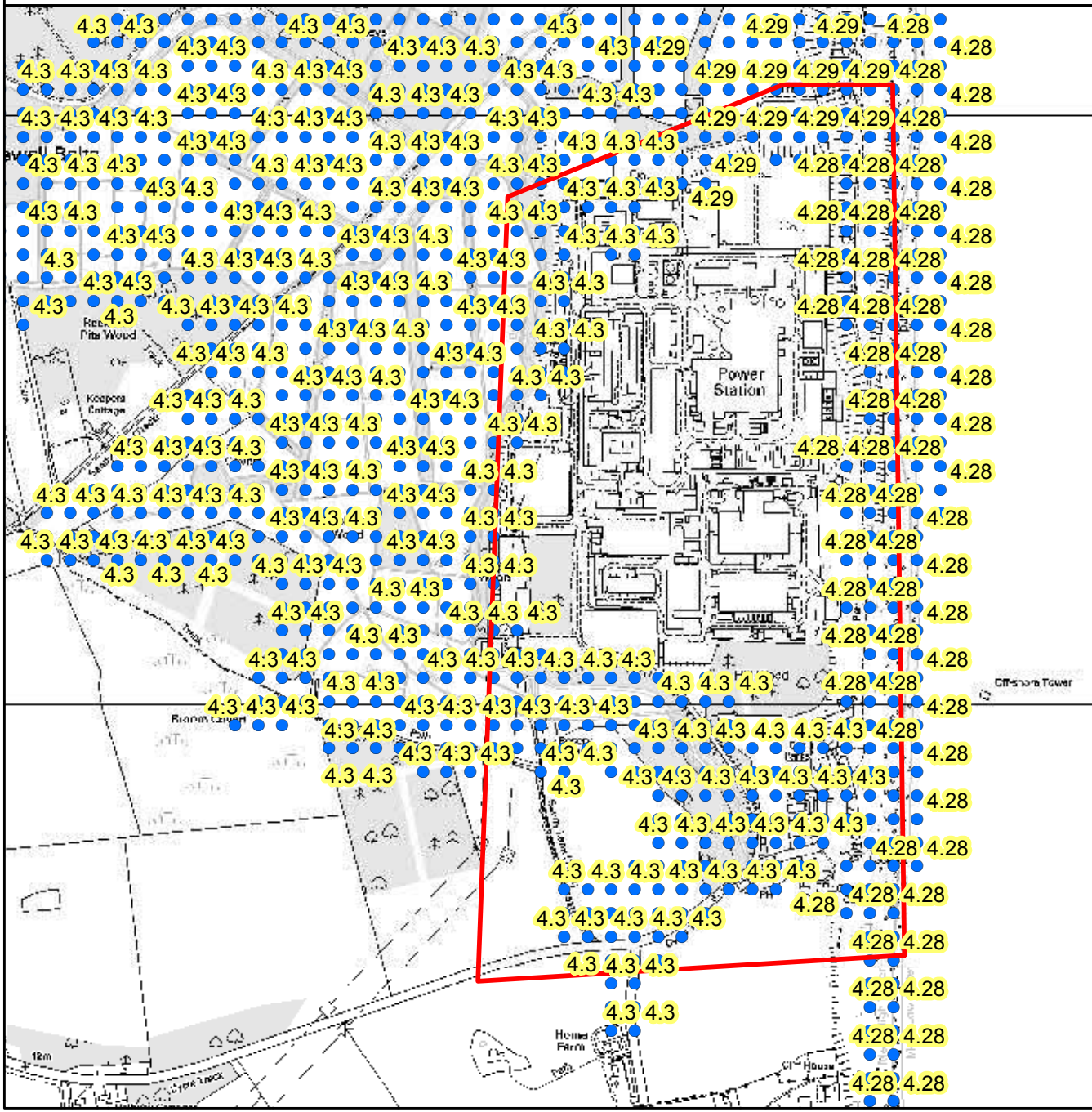

Environment Agency

Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500

Metres

1:10,500

Legend

Site Location

1 in 200 (+CC)

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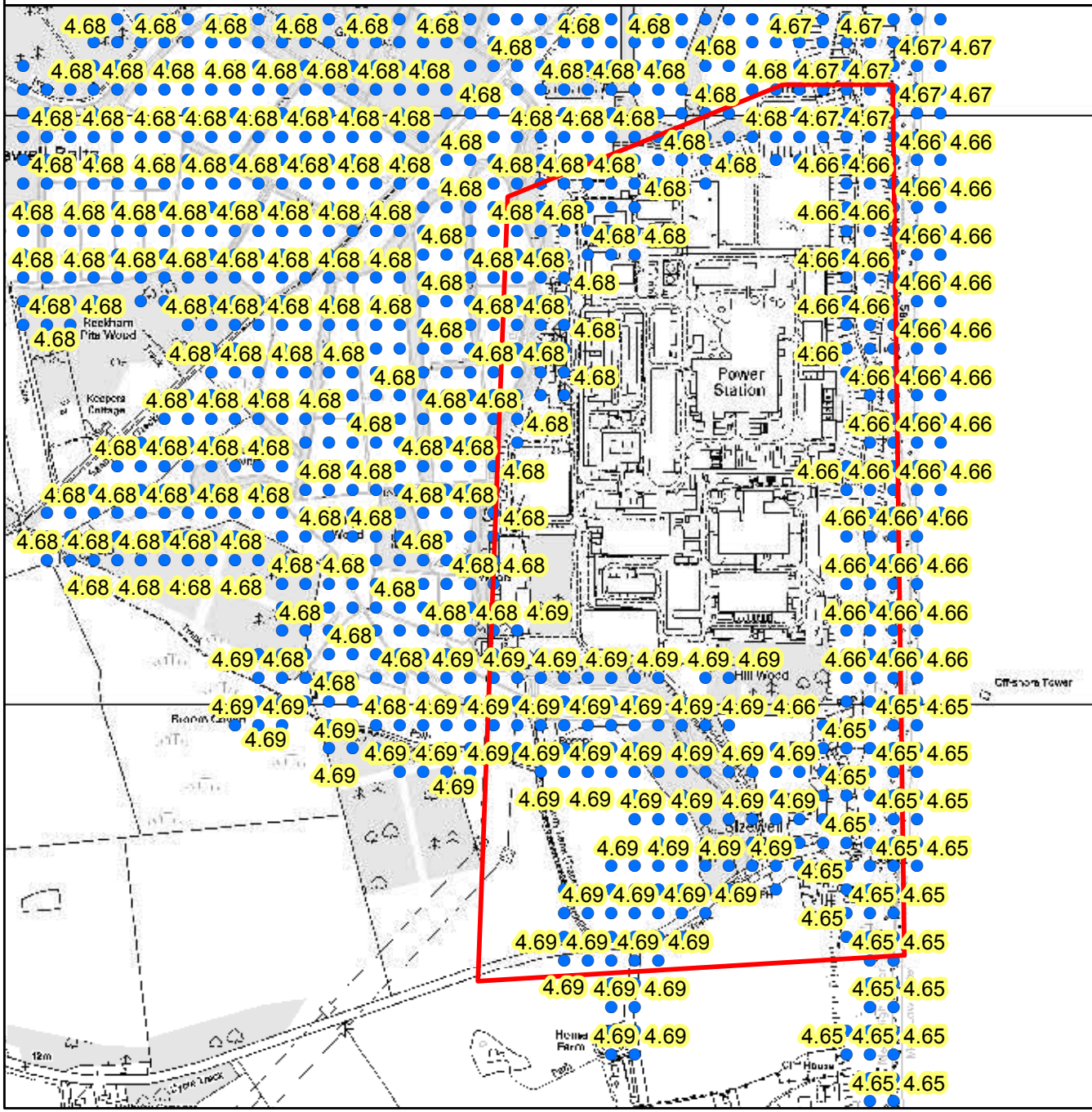

Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 125 250 500

Metres

1:10,500

Legend

Site Location

1 in 1000 (+CC)

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Breach Location Mapping - Leiston Breach

Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 180 360 720

Metres

1:15,000

Legend

Main Rivers

Breach_Location

This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of the flood water, and the maximum values of these are also mapped.

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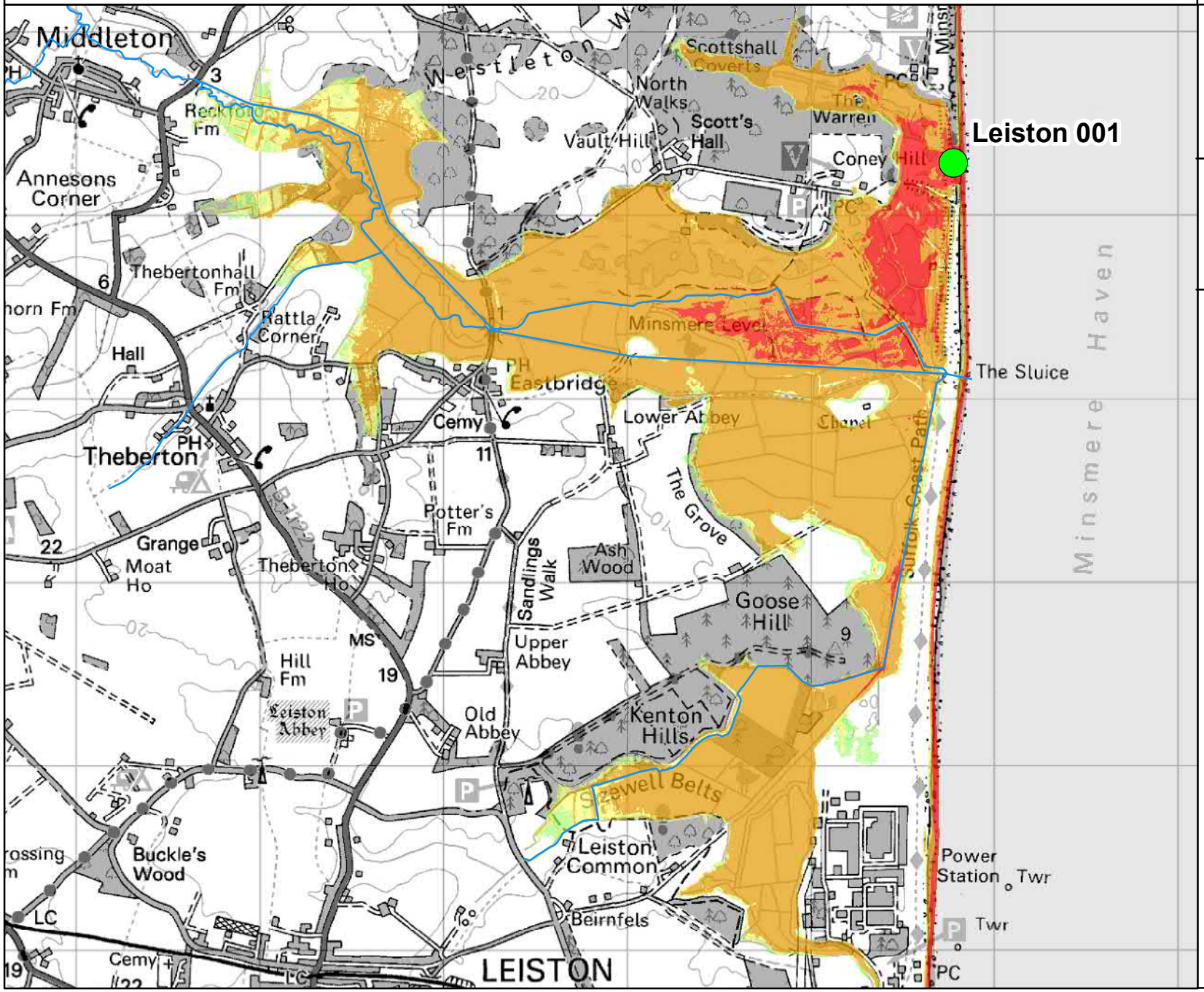
Breach Hazard Mapping - Leiston Breach



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 350 700 1,400

Metres

1:30,000

Legend

Main Rivers

Breach_Location

Max Hazard - 200 Year Present Day

- Less than 0.75 (Low Hazard)
- Between 0.75 and 1.25 (Danger for Some)
- Between 1.25 and 2.00 (Danger for Most)
- Greater than 2.00 (Danger for All)

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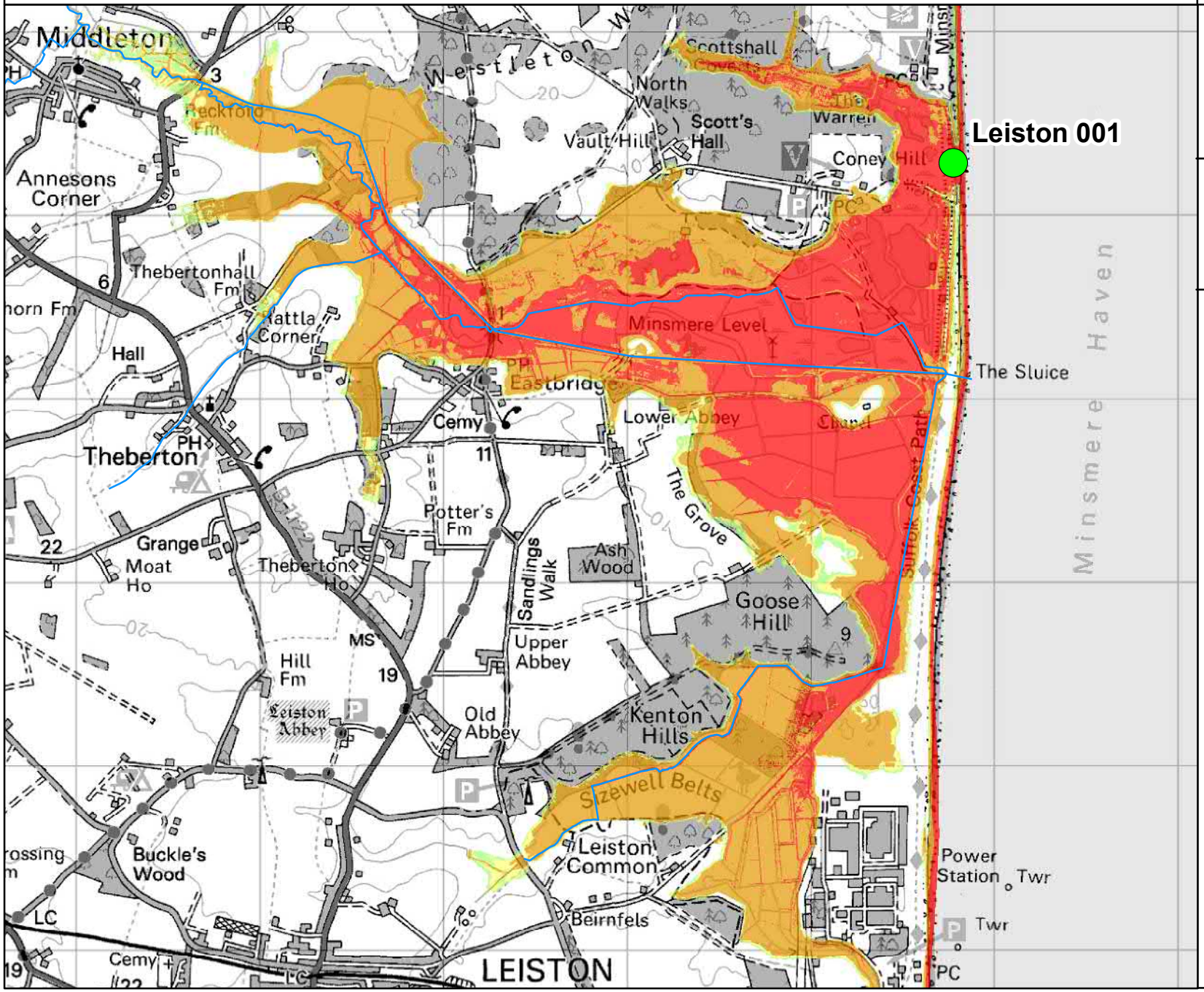

Environment Agency
Iceni House
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Metres

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Legend

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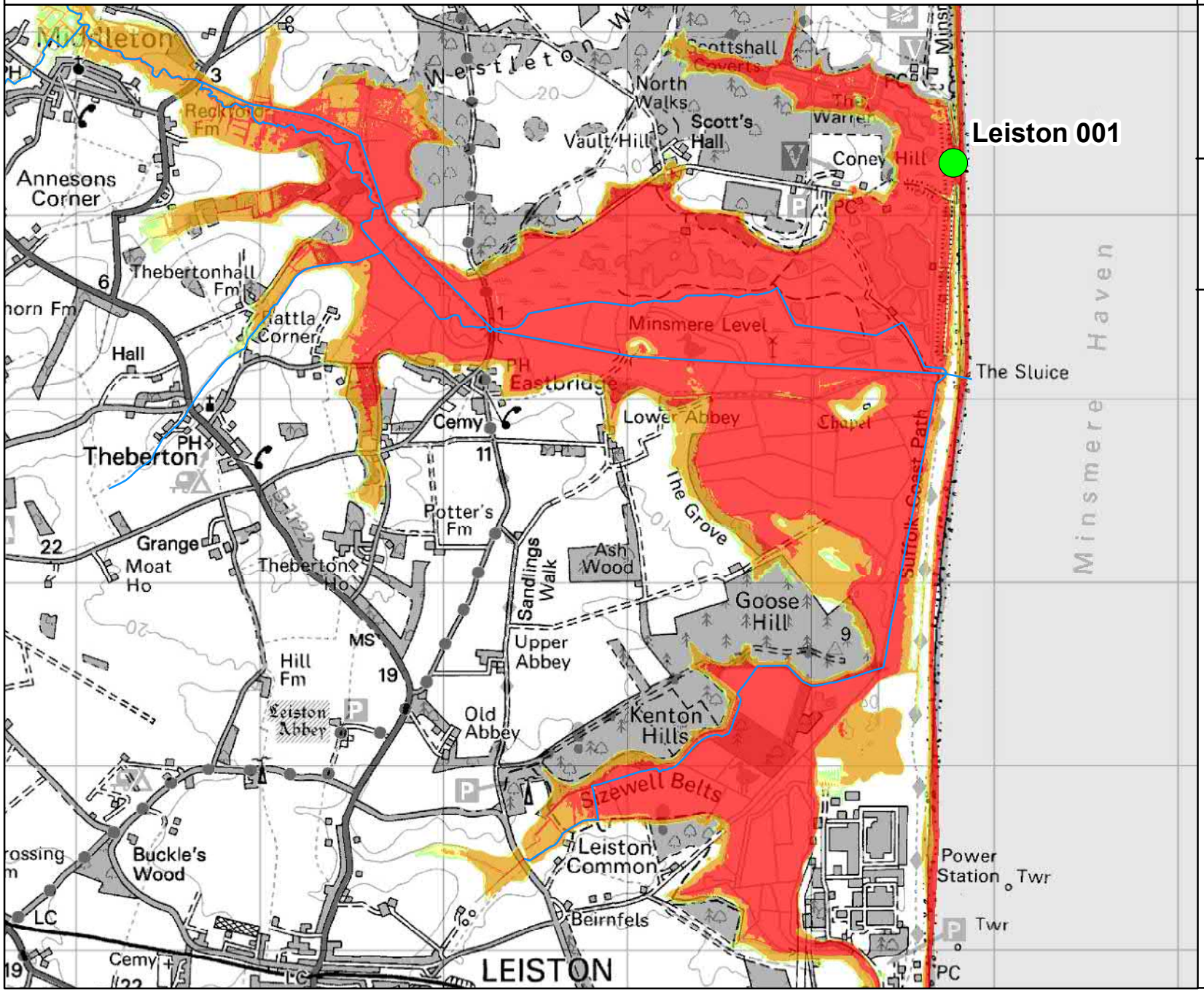

Environment Agency
Iceni House
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0 350 700 1,400

Metres

1:30,000

Legend

Main Rivers

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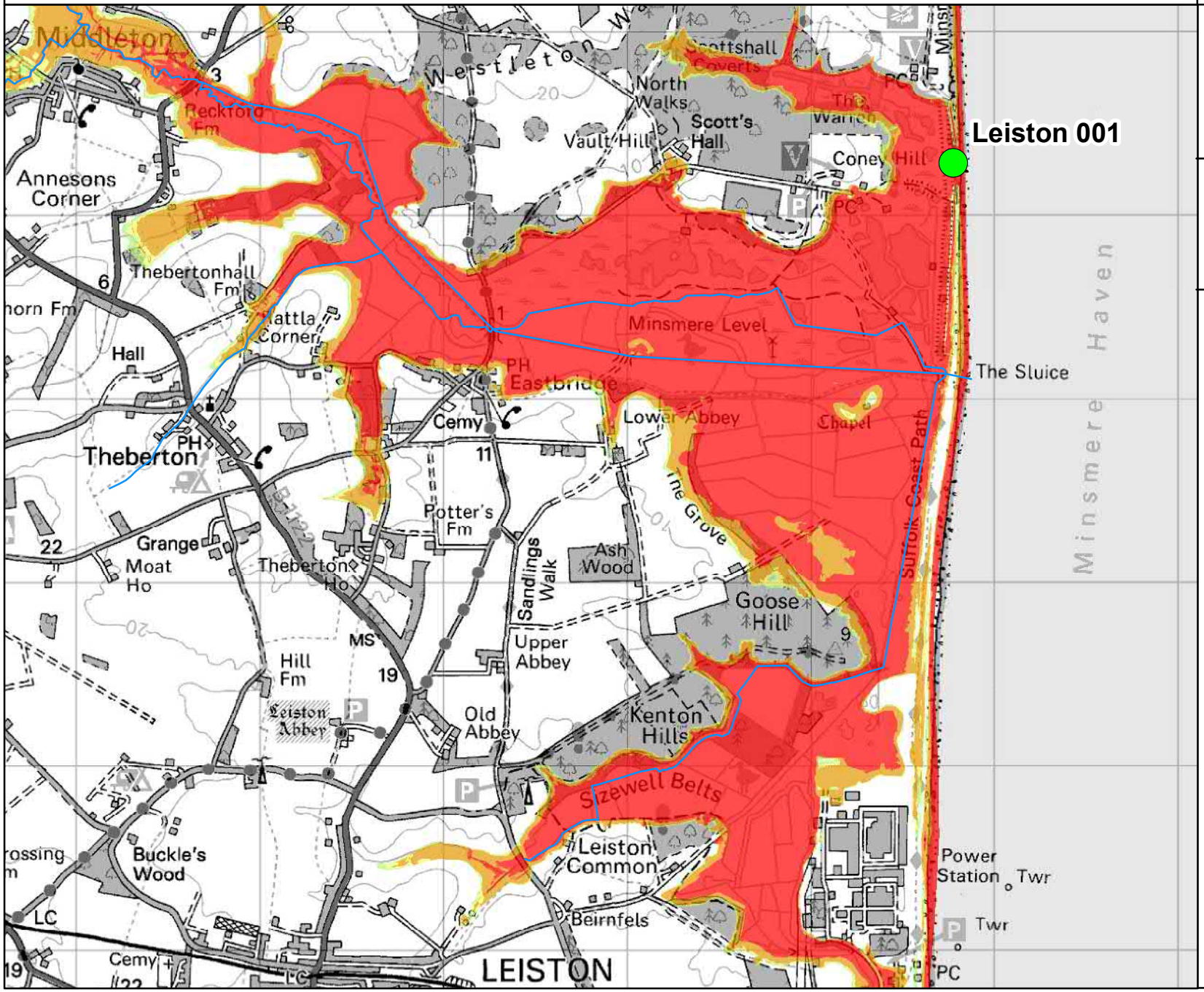

Environment Agency
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IP3 9JD

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0 350 700 1,400

Metres

1:30,000

Legend

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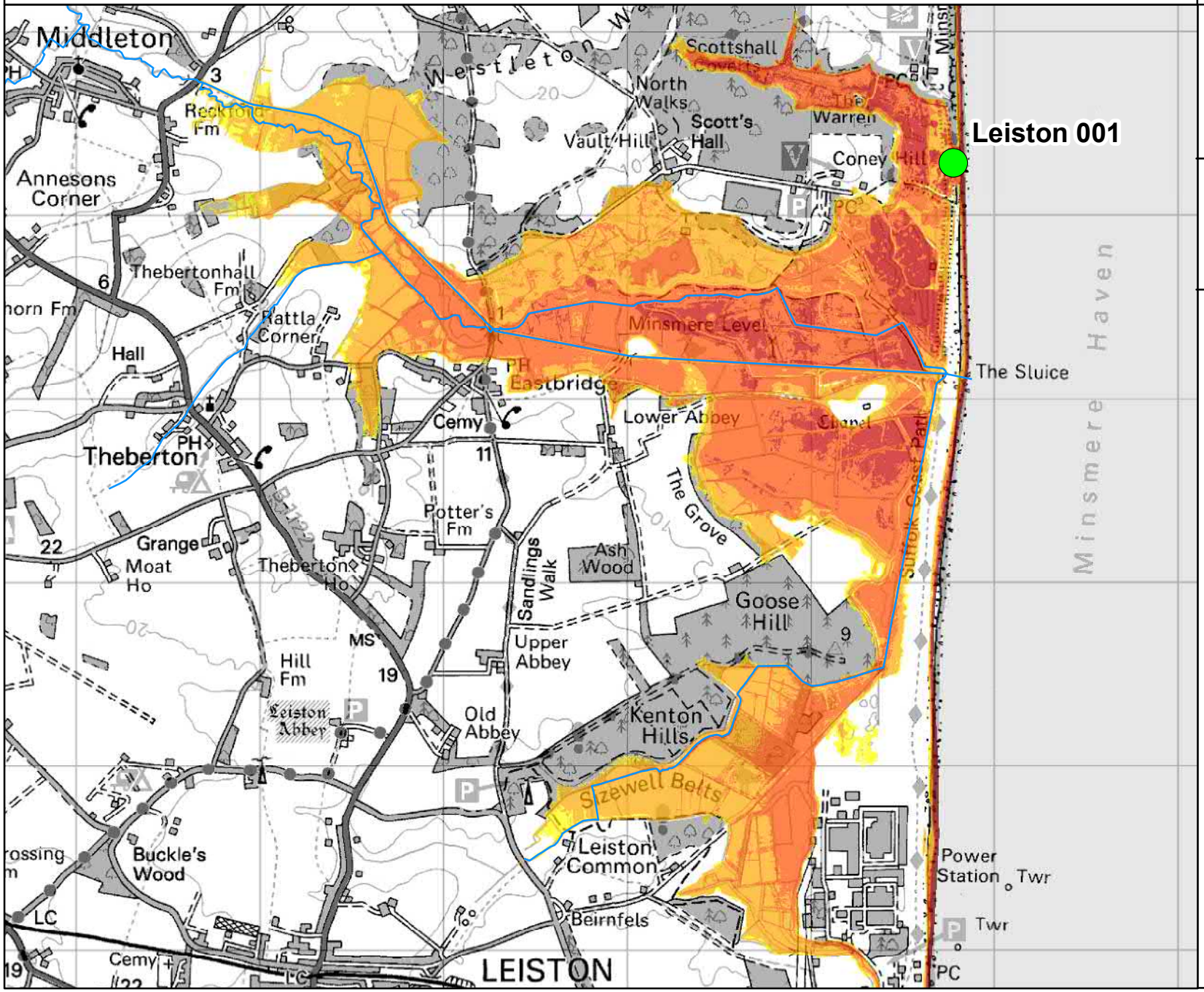
Breach Depth Mapping - Leiston Breach



Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 350 700 1,400

Metres

1:30,000

Legend

Main Rivers

Breach_Location

Max Depth (m) 200 Year Present Day

- 0 - 0.000000001
- 0 - 0.25
- 0.25 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- > 2.00

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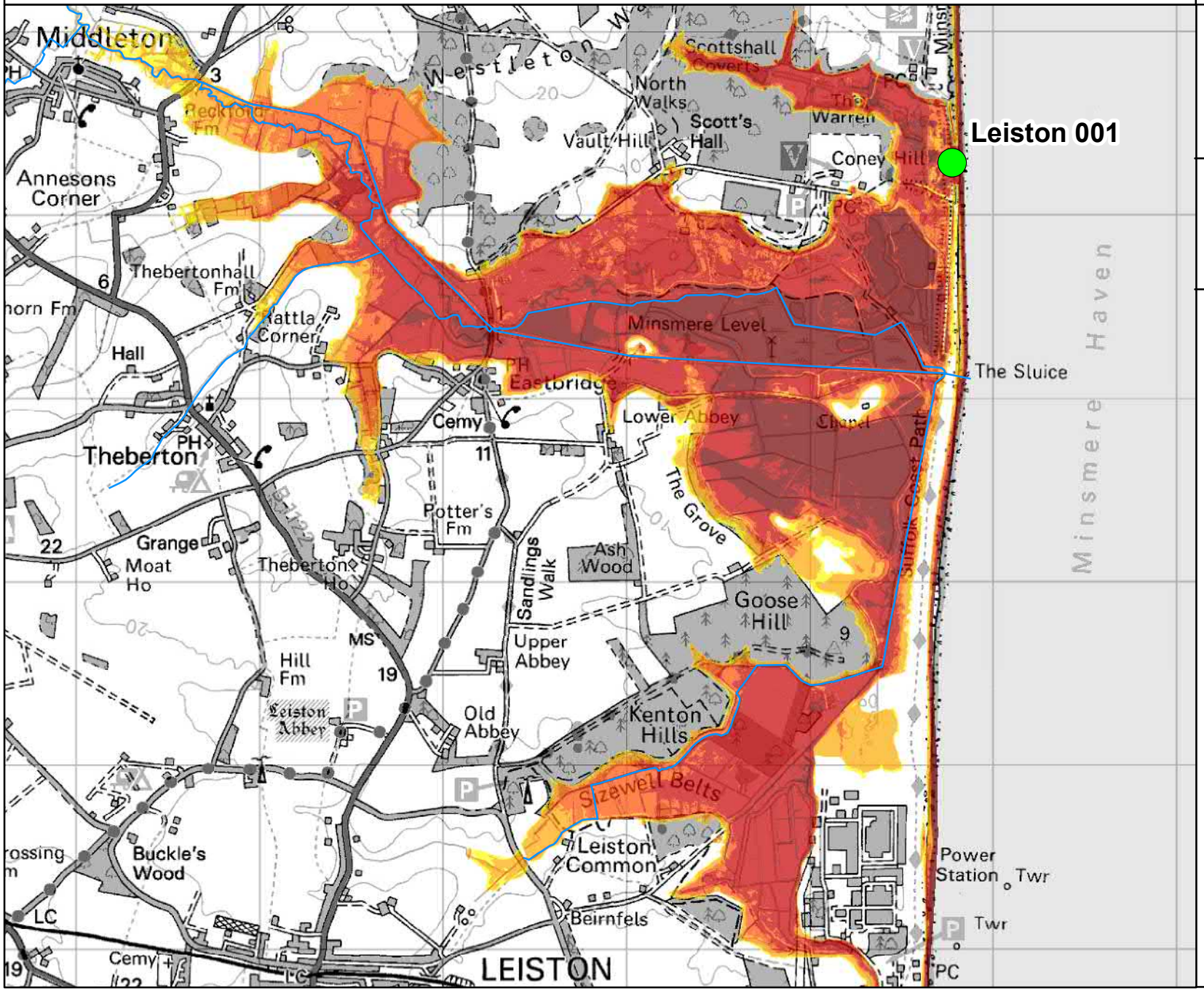

Environment Agency

Environment Agency
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0 350 700 1,400

Metres

1:30,000

Legend

Main Rivers

Breach_Location

Max Depth (m) 1000 Year Present Day

- 0 - 0.000000001
- 0 - 0.25
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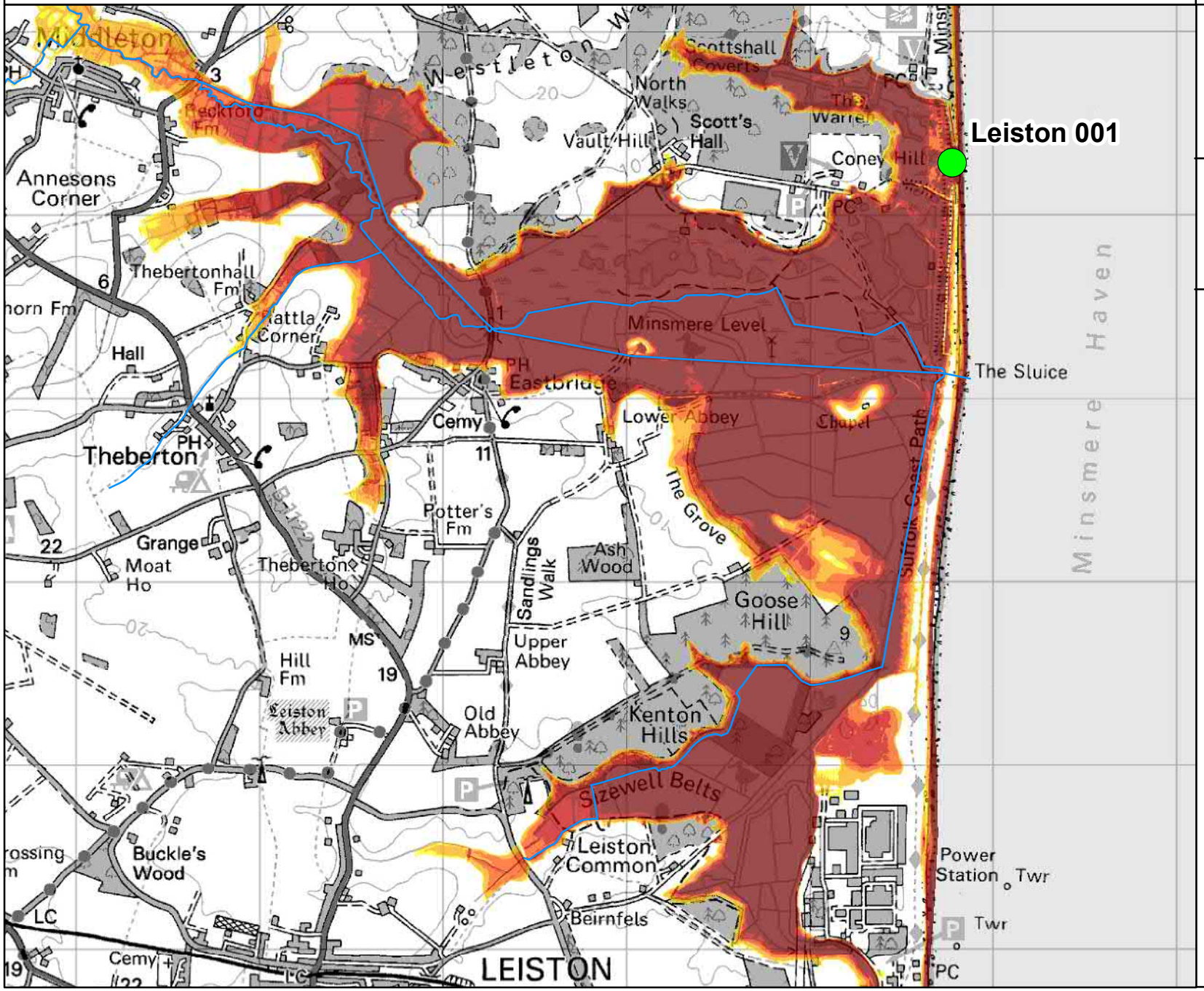

Environment Agency
Iceni House
Cobham Road
Ipswich
Suffolk
IP3 9JD

N

0 350 700 1,400

Metres

1:30,000

Legend

Main Rivers

Breach_Location

Max Depth (m) 200 Year Climate Change

- 0 - 0.000000001
- 0 - 0.25
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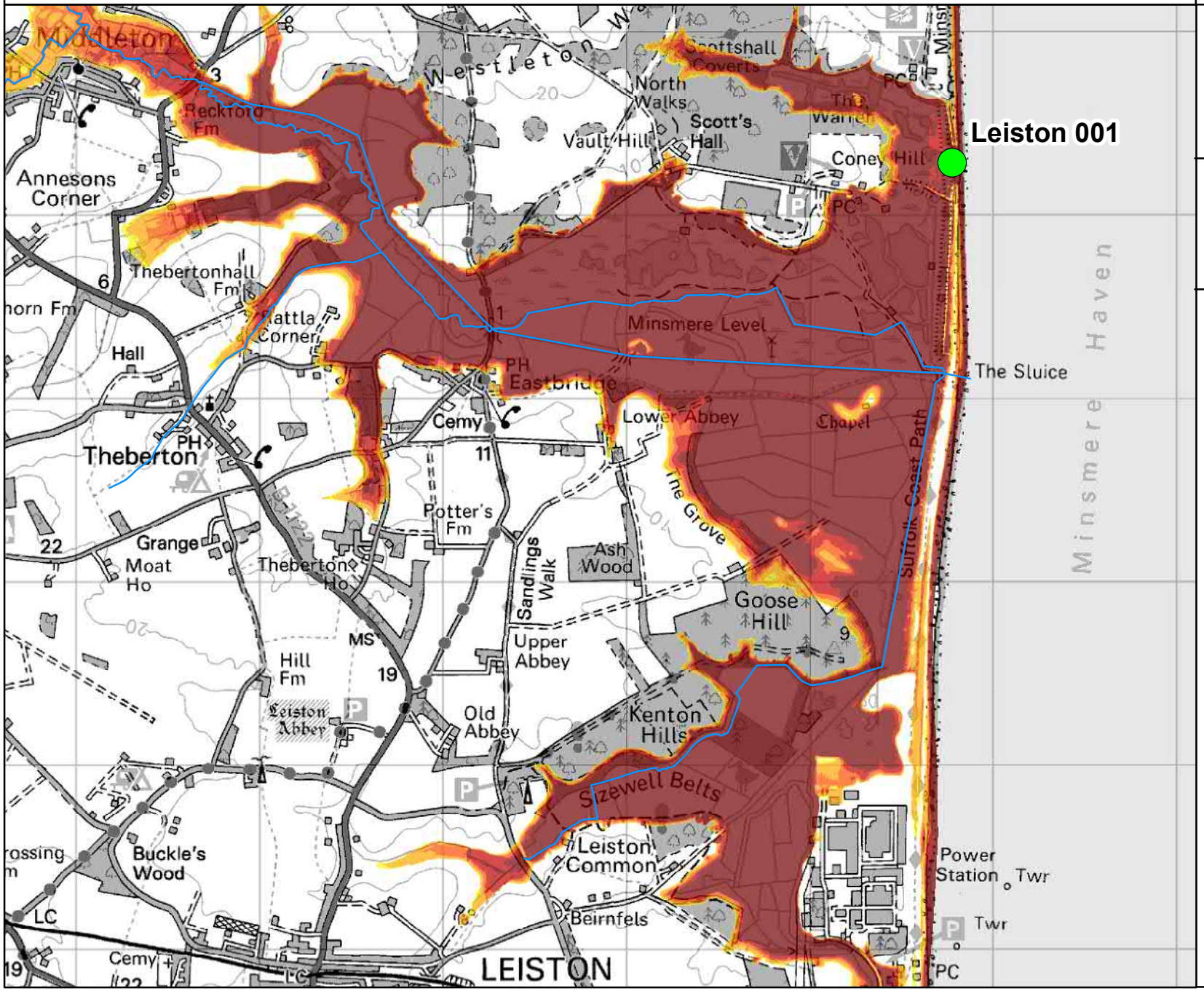

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N

0 350 700 1,400

Metres

1:30,000

Legend

Main Rivers

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East Anglia: Essex, Norfolk & Suffolk

APPENDIX 7 - SIZEWELL B RELOCATED FACILITIES FLOOD RISK ASSESSMENT ADDENDUM

Sizewell B Relocated Facilities

Flood Risk Assessment Addendum

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CONTENTS

TABLES

FIGURES

APPENDICES

1. Introduction

1.1 Background

1.1.1 Following submission of the Sizewell B Relocated Facilities planning application (DC/2019/124070/01-L01), the Environment Agency provided East Suffolk Council with their statutory consultee response on 17 May 2019.

1.1.2 In a letter to East Suffolk Council, dated 17 May 2019, the Environment Agency raised a holding objection (reference DC/19/1637/FUL) on flood risk grounds and stated that further information was required in order to make a decision on the application. The additional information requested was:

- a GPS verified topographic survey;
- information on mitigation measures to manage the residual risk of a breach flood; and
- confirmation of the lifetime of the development and therefore the length of planning permission sought.

1.2 Scope and format of report

1.2.1 The aim of this Flood Risk Assessment Addendum (hereafter referred to as *addendum*) is to address the Environment Agency's concerns and provide clarity on the existing information submitted to support the conclusions set out within the Flood Risk Assessment. However, the conclusions of the FRA submitted with the planning application remain unchanged.

1.2.2 This addendum should be read in conjunction with the Flood Risk Assessment (*Ref. SZB RF FRA RevD*) (*FRA*) submitted with the planning application. Where information for clarification is presented within this report, it is intended that this supersedes the original content of the FRA. Wherever possible, details which supersede previous information have been highlighted within the addendum.

1.2.3 The Environment Agency's response letter in full is provided as **Appendix 1A** of this addendum. The addendum addresses the three main areas where clarification was sought by the Environment Agency in turn in the subsequent sections. Additionally, it provides clarity on the points raised by the Environment Agency at the rear of their response under the heading "Flood Risk Technical Appendix".

2. Clarification information regarding topographic survey

2.1 Summary of Environment Agency comments

2.1.1 The FRA references remotely sensed topographic levels obtained from LiDAR throughout the FRA report. However, the Environment Agency state that this may not be accurate due to tree coverage in the area and recommend that a GPS verified topographic survey is undertaken to ensure the site levels used and flood depths calculated are accurate.

2.2 Approach utilised to address comment

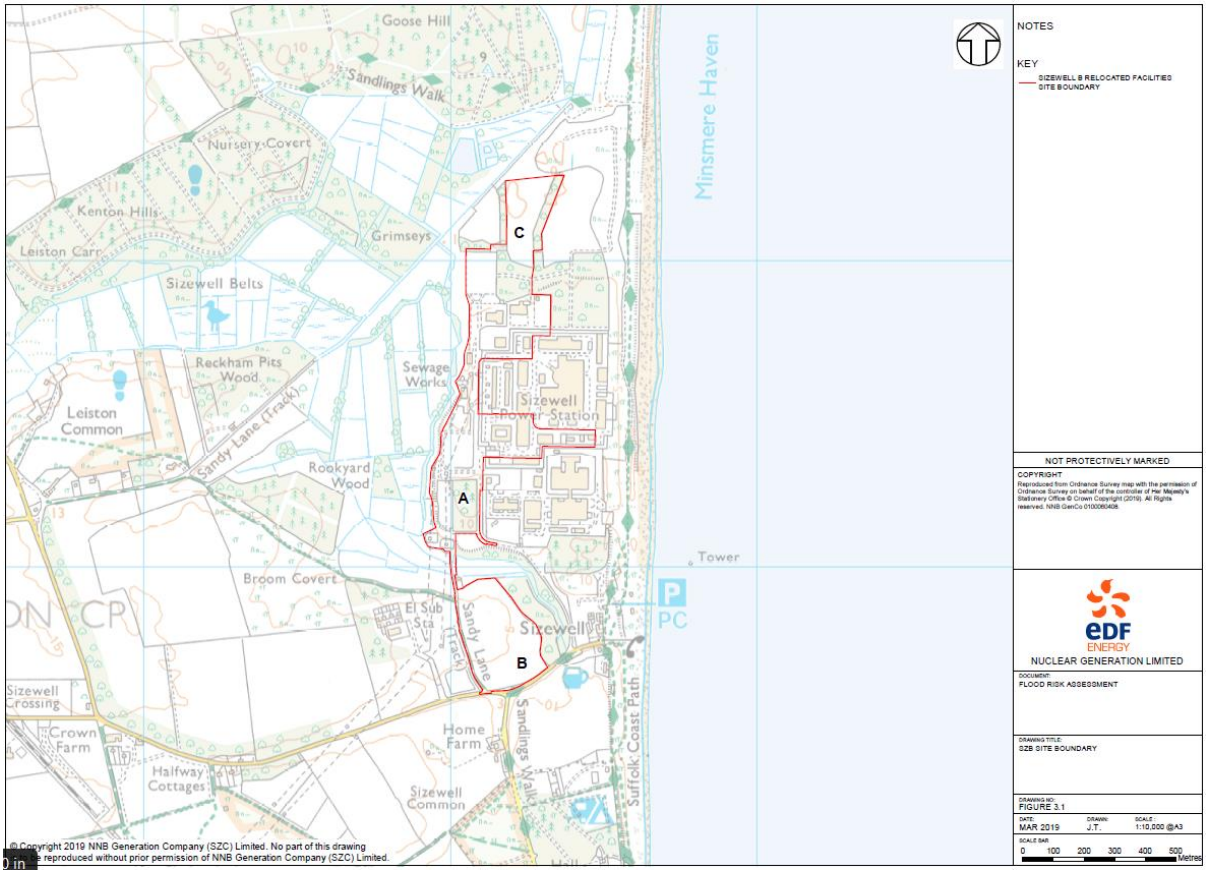
2.2.1 The requirement for a topographic survey is based on a need for accuracy in relation to site levels and the flood depths calculated from these levels.

2.2.2 Topographic levels were provided within the FRA for Field 2 and Pillbox Field based on the LiDAR data and are considered to be appropriate as there is little tree coverage in these locations. The potential for remotely sensed topographic levels to pick up the tree canopy level at Coronation Wood was highlighted within paragraph 3.1.7 of the FRA.

2.2.3 Notwithstanding, the above this addendum focuses on these three key areas as they are the three undeveloped geographical areas within the site which form the focus of the proposed development. These are summarised as:

- Coronation Wood (Marked A on Figure 2-1);
- Pillbox Field (Marked B on Figure 2-1); and
- Field 2 (Marked C on Figure 2-1).

Figure 2-1: Copy of FRA Figure 3-1: Site boundary with named undeveloped areas highlighted



2.3 Topographic levels

2.3.1 A GPS verified topographic survey (Ref SZC-SZ0100-XX-000-DRW-100003, dated October 2017) is available for the main areas of the Sizewell B site, including the Coronation Wood (A) area, the Pillbox Field (B) and Field 2 (C) proposed for development. Each of these areas has been discussed in the following sections. A copy of the GPS verified topographic survey is included as **Appendix 1B** of this addendum.

a) Coronation Wood

2.3.2 The topographic survey shows levels within the Coronation Wood area to be between 8.74m AOD and 12.21m AOD. The lowest topographic levels are located towards the south-east corner of Coronation Wood.

2.3.3 The remotely sensed topographic data used within the FRA identifies topographic levels within Coronation Wood to be approximately 7.9m AOD.

2.3.4 Comparing the topographic levels from the remotely sensed LiDAR with the topographic survey the levels were in the region of 0.84m lower for the LiDAR data than those obtained by the topographic survey.

2.3.5 As such it can be concluded that the topographic levels obtained using the remotely sensed LiDAR and presented in the FRA were conservative within the Coronation Wood area. Therefore, any flood risk analysis undertaken within the FRA using the LiDAR levels represented a conservative approach to flood risk within the Coronation Wood area.

b) Pillbox Field

2.3.6 The topographic survey shows levels within the Pillbox Field are between 1.38m AOD and 8.85m AOD. The lowest topographic levels are located along the southern boundary of the field adjacent to the Sizewell Gap road and along the eastern boundary of the field adjacent to the watercourse.

2.3.7 The remotely sensed topographic data used within the FRA identifies topographic levels within Pillbox Field to be approximately 1.7m AOD.

2.3.8 Within paragraph 3.1.17 of the FRA it is noted that the proposed outage car park is to be located at the northern end of Pillbox Field. This addendum notes that a sequential approach has been adopted for the location of the proposed outage car park i.e. within Flood Zone 1 and at the highest topographical level within the red line boundary.

2.3.9 This addendum has reviewed the levels from the topographic survey which show that the proposed outage car park is to be located above 4m AOD.

c) Field 2

2.3.10 The topographic survey shows levels within Field 2 are between 1.40m AOD and 1.90m AOD. The lowest topographic levels are located to the north of the field in proximity to an existing ditch.

2.3.11 The remotely sensed topographic data used within the FRA identifies topographic levels within Field 2 to be approximately 1.8m AOD.

2.3.12 This addendum has reviewed the ground levels, from the topographic survey, for Field 2 in comparison with the maximum water levels during an event. The lowest topographical level for Field 2 of 1.4m AOD has been used for assessment purposes.

2.4 Tidal flood risk update

2.4.1 Table 2-1 of this addendum clarifies the information related to the modelled water levels outlined within Table 4-1 of the FRA and supersedes the findings of paragraphs 4.1.6 and 4.1.7 of the FRA.

Table 2-1: Undefended tidal flood risk – utilising present day topography

Site area	Topographic level (m AOD)	1 in 200 year event		1 in 1,000 year event	
		Modelled undefended water level (m AOD)	Maximum flood depth (m)	Modelled undefended water level (m AOD)	Maximum flood depth (m)
Coronation Wood	8.74	Outside flood extent	None	Outside flood extent	None
Pillbox Field	1.38	3.11	1.73	3.58	2.20
Field 2	1.40	3.11	1.71	3.56	2.16

2.4.2 Coronation Wood is located above the undefended modelled flood extent during both the 1 in 200 year and 1 in 1,000 year event.

2.4.3 Although the undefended model scenarios indicate there would be flooding to the Pillbox Field during the 1 in 200 year event and the 1 in 1,000 year event the proposed outage car park is to be located above 4m AOD. Therefore, it would be located above the maximum undefended modelled water level during both the 1 in 200 year and 1 in 1,000 year event.

2.4.4 Field 2 is located at a topographical level such that there would be flooding, based on the undefended scenario, during both the 1 in 200 year and 1 in 1,000 year event.

2.4.5 Following restoration ground levels within Field 2 could be raised 0.8m to a minimum of 2.20m AOD. Table 2-2 of this addendum presents how this alteration to ground level could affect flood depths on site.

Table 2-2: Undefended tidal flood risk – post restoration ground levels (not accounting for climate change)

Site area	Topographic level (m AOD)	1 in 200 year event		1 in 1,000 year event	
		Modelled undefended water level (m AOD)	Maximum flood depth (m)	Modelled undefended water level (m AOD)	Maximum flood depth (m)
Field 2	2.2	3.11	0.91	3.56	1.38

2.4.6 This addendum notes that the above information is based on the undefended model scenario and that defended model scenarios indicate there would be no flooding to Coronation Wood, Pillbox Field or Field 2 during the present day 1 in 200 year and 1 in 1,000 year events, therefore confirming that flood risk to these locations during the above events is classified as a residual risk.

2.4.7 Paragraphs 4.1.8 and 4.1.9 of the FRA state that the site would be unaffected by coastal flooding in the defended scenario for all return periods

up to the 1 in 1,000-year event and therefore tidal flood risk on site is considered to be low.

2.4.8 The data presented in Table 2-1 and Table 2-2 of this addendum does not alter this conclusion.

2.5 Fluvial flood risk update

2.5.1 Table 2-3 and Table 2-4 of this addendum clarifies the modelled water levels outlined within Table 4-2 of the FRA and supersedes the findings of paragraphs 4.1.11 and 4.1.12 of the FRA.

Table 2-3: Undefended in-channel fluvial flood risk – utilising present day topography

Site area	Topographic level (m AOD)	1 in 100 year event		1 in 1,000 year event	
		Modelled undefended in-channel water level (m AOD)	Maximum flood depth (m)	Modelled undefended water level (m AOD)	Maximum flood depth (m)
Coronation Wood	8.74	Outside flood extent	None	Outside flood extent	None
Pillbox Field	1.38	0.95	None	1.12	None
Field 2	1.40	0.95	None	0.95	None

2.5.2 Coronation Wood is located above the modelled fluvial water level during both the 1 in 100 year and 1 in 1,000 year event. Pillbox Field and the proposed outage car park are located above the modelled fluvial water level during both the 1 in 100 year and 1 in 1,000 year event. Field 2 is also located above the modelled fluvial water level during both the 1 in 100 year and 1 in 1,000 year event.

2.5.3 Following restoration ground levels within Field 2 could be raised 0.8m to a minimum of 2.20m AOD. Table 2-4 presents how this alteration to ground level could affect fluvial flood depths on site.

Table 2-4: Undefended in-channel fluvial flood risk – post restoration ground levels (not accounting for climate change)

Site area	Topographic level (m AOD)	1 in 100 year event		1 in 1,000 year event	
		Modelled undefended in-channel water level (m AOD)	Maximum flood depth (m)	Modelled undefended water level (m AOD)	Maximum flood depth (m)
Field 2	2.2	0.95	None	0.95	None

2.5.4 Analysis of topographic levels from the topographic survey and modelled water levels show the three locations are all topographically higher than the modelled water levels. Therefore, the site can be confirmed as being at low fluvial flood risk.

2.6 Groundwater flood risk update

2.6.1 Long term groundwater monitoring associated with various phases of development on the site indicate groundwater levels within the Crag Group are typically between 0.0m AOD and 1.0m AOD.

2.6.2 Analysis of these groundwater levels with topographic levels from the topographic survey within this addendum confirm the findings of the FRA in paragraph 4.1.21 that groundwater flood risk is low at all three geographical site areas.

3. Clarification information regarding mitigation measures to manage residual risk

3.1 Summary of Environment Agency comments

3.1.1 The Environment Agency's response states that where safe access cannot be achieved, or if the development would be at residual risk of flooding in a breach, an emergency flood plan that deals with matters of evacuation and refuge should demonstrate that people will not be exposed to flood hazards. The Environment Agency has requested that it is confirmed that a flood warning and evacuation flood plan will be produced.

3.2 Confirmation of defended status (tidal flood risk)

3.2.1 Modelled tidal water levels considering climate change and the coastal defences have been provided by the Environment Agency as part of a Product 4 data package (example shown in Figure 3-1).

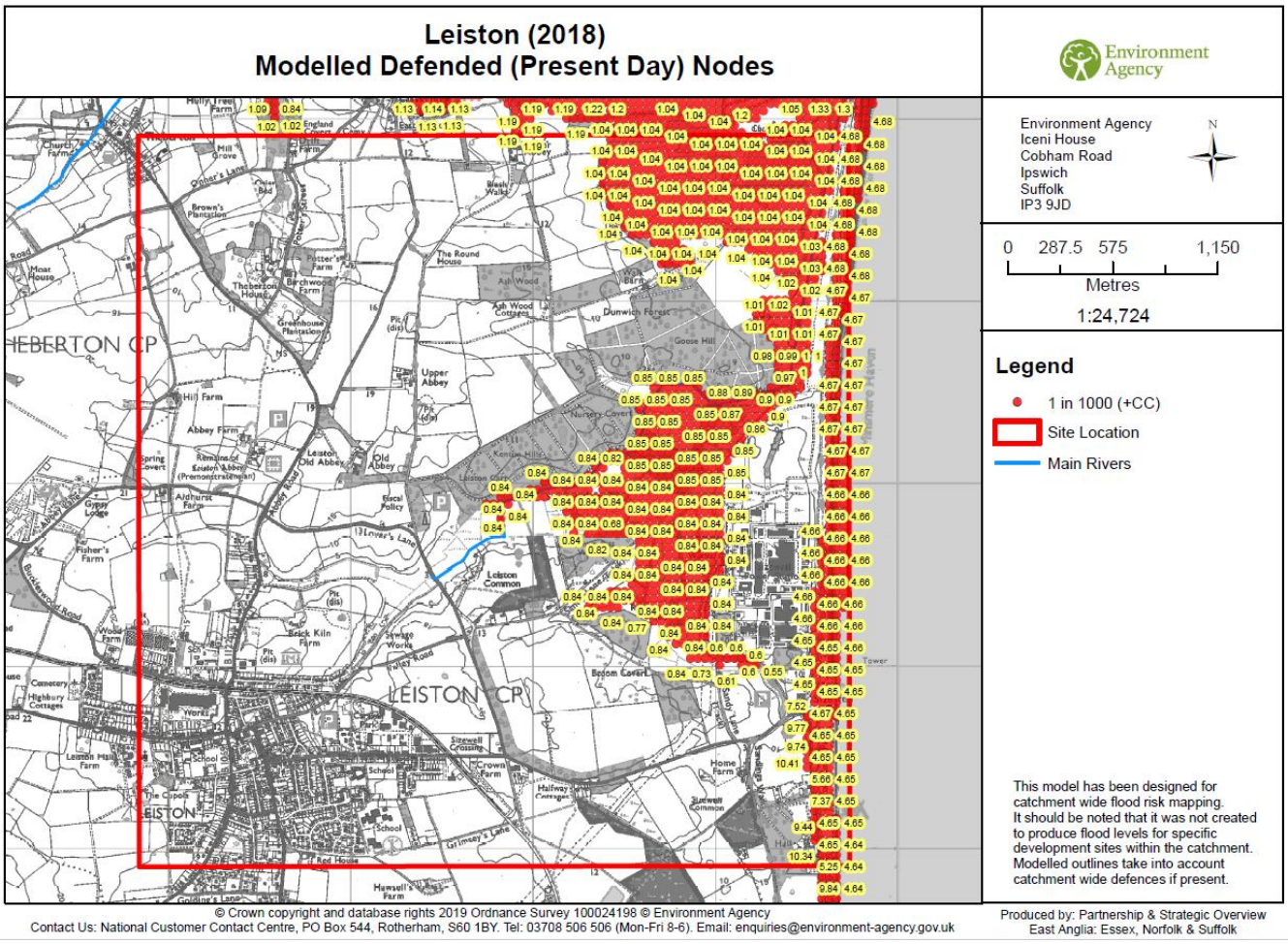
3.2.2 Analysis of these modelled water levels and modelled flood extents against the topographic levels described in Section 2 has confirmed that Coronation Wood is located topographically higher than the defended modelled water levels with climate change. Analysis of the modelled water levels maps also confirms that Pillbox Field and Field 2 are located outside of the modelled 1 in 200 year and 1 in 1,000-year flood extents (Table 3-1).

Table 3-1: Defended tidal flood risk with an allowance for climate change – utilising present day topography

Site area	Topographic level (m AOD)	1 in 200 year event with climate change		1 in 1,000 year event with climate change	
		Modelled defended water level (m AOD)	Maximum flood depth (m)	Modelled defended water level (m AOD)	Maximum flood depth (m)
Coronation Wood	8.74	0.84	None	0.84	None
Pillbox Field	1.38	No modelled water levels (outside modelled flood extent)	None	No modelled water levels (outside modelled flood extent)	None
Field 2	1.40	No modelled water levels (outside modelled flood extent)	None	No modelled water levels (outside modelled flood extent)	None

3.2.3 Table 3-1 supersedes Table 5-2 of the FRA. The findings of the FRA in paragraph 5.1.17 state that the proposed development will be located outside the modelled defended tidal flood extents taking into consideration climate change and this is confirmed by Table 3-1 above.

Figure 3-1: Example of Environment Agency modelled water levels. 1 in 1,000 year event taking into account climate change and coastal defences.



3.3 Residual reservoir flood risk

3.3.1 The Environment Agency's response states that:

> *"Reservoir failure flood extent cuts across the access road to the Pillbox Field car park so this should be considered in any flood warning and evacuation plan."*

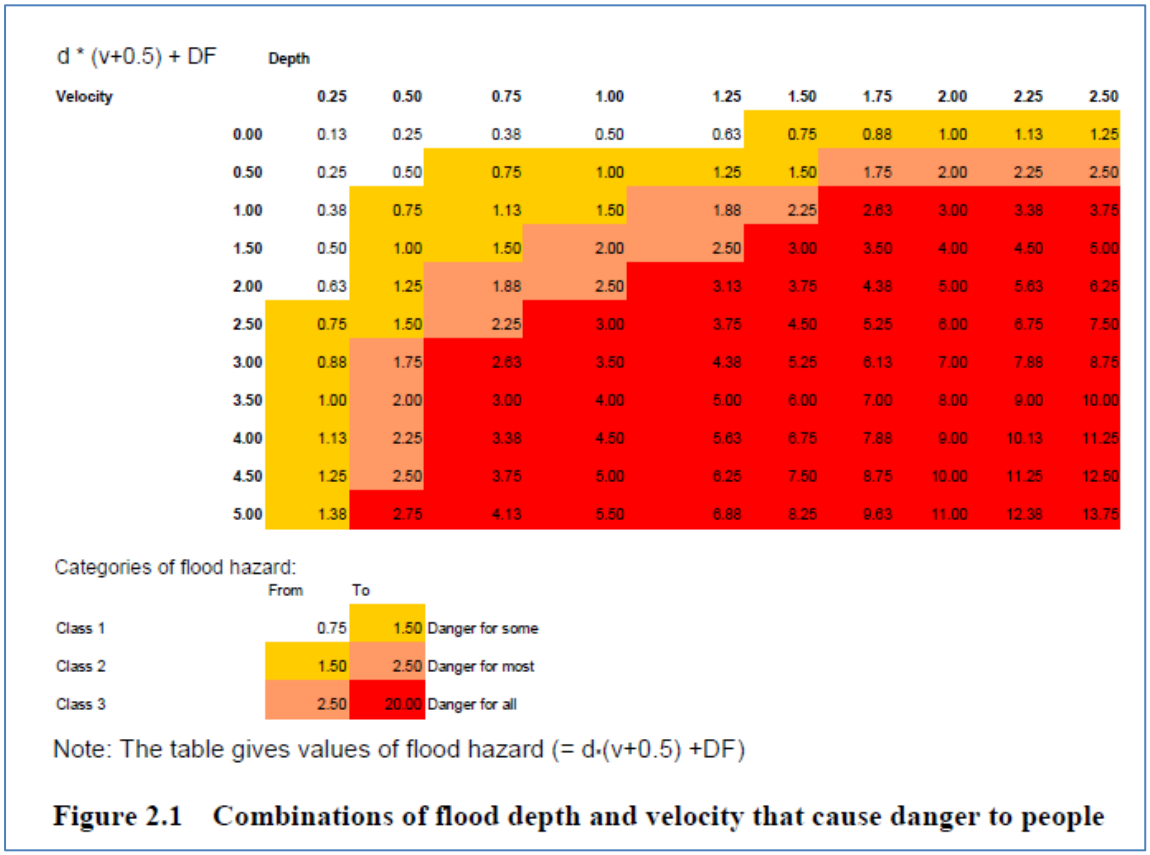
3.3.2 This addendum has reviewed the online flood risk from reservoirs mapping. It shows that on the access road flood water would be less than 0.3m deep with a velocity of less than 0.5m/s.

3.3.3 Utilising the flood hazard table (Figure 3-2) and a conservative approach to depth (0.5m) and velocity (0.5m/s) this results in a hazard rating of 0.50. Based on the categories of flood hazard the reservoir flood risk at the site

would be unclassified and below the minimum category which is classed as a danger for some.

3.3.4 Given that the residual reservoir flood risk is unclassified use of the access road to the Pillbox Field car park during a reservoir flood event would not require a detailed flood warning and evacuation plan.

Figure 3-2: Flood hazard table (*Source: Flood Risks to People, Defra and Environment Agency, March 2006*)



d * (v+0.5) + DF

Velocity \ Depth	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
0.00	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.00	1.13	1.25
0.50	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
1.00	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75
1.50	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
2.00	0.63	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63	6.25
2.50	0.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50
3.00	0.88	1.75	2.63	3.50	4.38	5.25	6.13	7.00	7.88	8.75
3.50	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
4.00	1.13	2.25	3.38	4.50	5.63	6.75	7.88	9.00	10.13	11.25
4.50	1.25	2.50	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50
5.00	1.38	2.75	4.13	5.50	6.88	8.25	9.63	11.00	12.38	13.75

Categories of flood hazard:

	From	To	
Class 1	0.75	1.50	Danger for some
Class 2	1.50	2.50	Danger for most
Class 3	2.50	20.00	Danger for all

Note: The table gives values of flood hazard (= d·(v+0.5) +DF)

Figure 2.1 Combinations of flood depth and velocity that cause danger to people

3.4 Coastal defence breach

3.4.1 The Environment Agency provided details of a coastal defence breach located at Coney Hill, north of Minsmere Nature Reserve (*ID: Leiston 001*). The breach modelling considers a 1 in 200 year and 1 in 1,000 year event for both present day and with climate change scenarios. Within the original Environment Agency Product 8 data package (obtained January 2019), the maps showing breach depths and hazard ratings did not extend to cover the full extent of the southern area of Pillbox Field.

3.4.2 However, the Environment Agency provided additional breach mapping in July 2019 to supplement the Product 8 mapping obtained in January 2019, which included the breach depths within Pillbox Field. This is presented in Figure 3-3 for the 1 in 200 year present day event and Figure 3-4 for the 1 in 200 year with climate change event. The modelled depths and hazard ratings for the breach events are presented in Table 3-2.

3.4.3 Water levels have not been provided and as such comparison of maximum water levels with topographic levels to confirm whether an area would be affected cannot be undertaken.

Table 3-2: Residual breach flood risk and hazard rating

Site area	1 in 200 year event		1 in 1,000 year event	
	Present day depth (m) & Hazard rating	With climate change depth (m) & Hazard rating	Present day depth (m) & Hazard rating	With climate change depth (m) & Hazard rating
Coronation Wood	None No hazard	None No hazard	None No hazard	None No hazard
Pillbox Field (area for proposed Outage Car Park and Access Road)	None No hazard	None No hazard	None No hazard	None No hazard
Field 2	0 – 0.25 Low hazard	1.5 – 2.00 Danger to most	0.25 – 1.00 Low hazard	>2.00 Danger for all

Figure 3-3: Breach depth mapping for the 1 in 200 year present day event

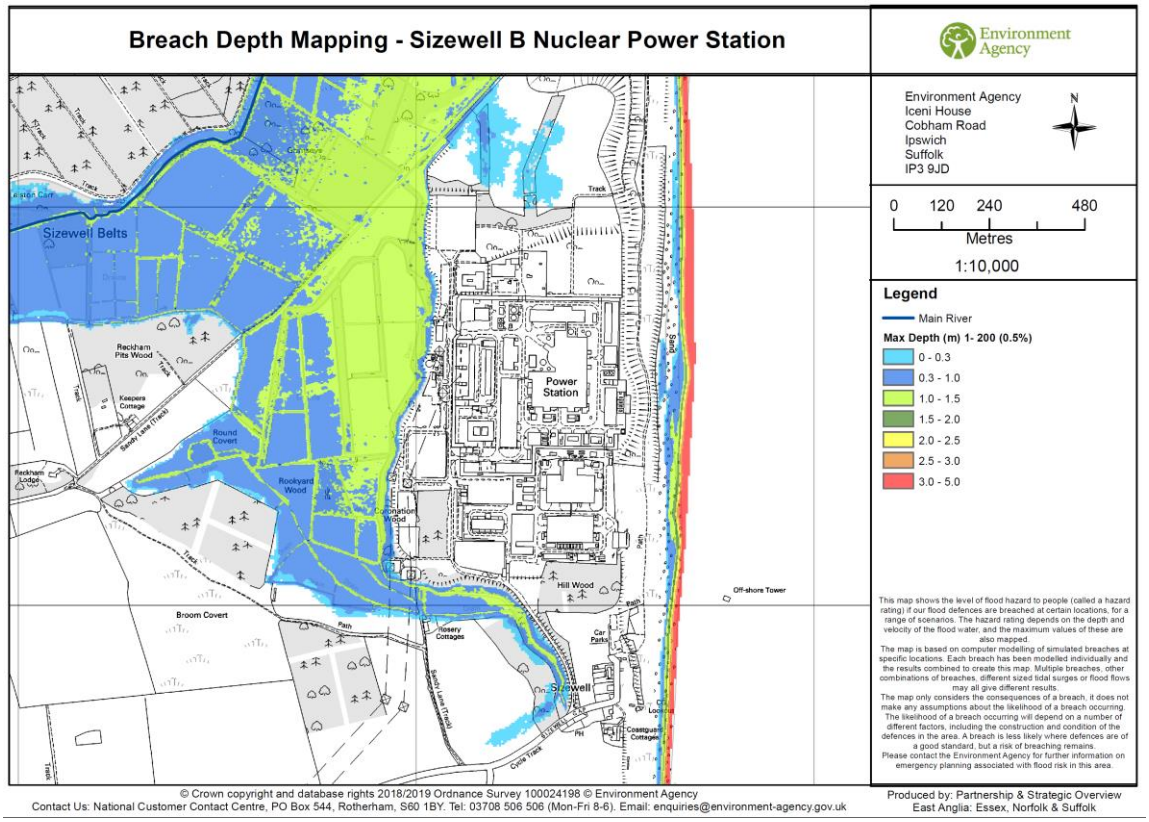
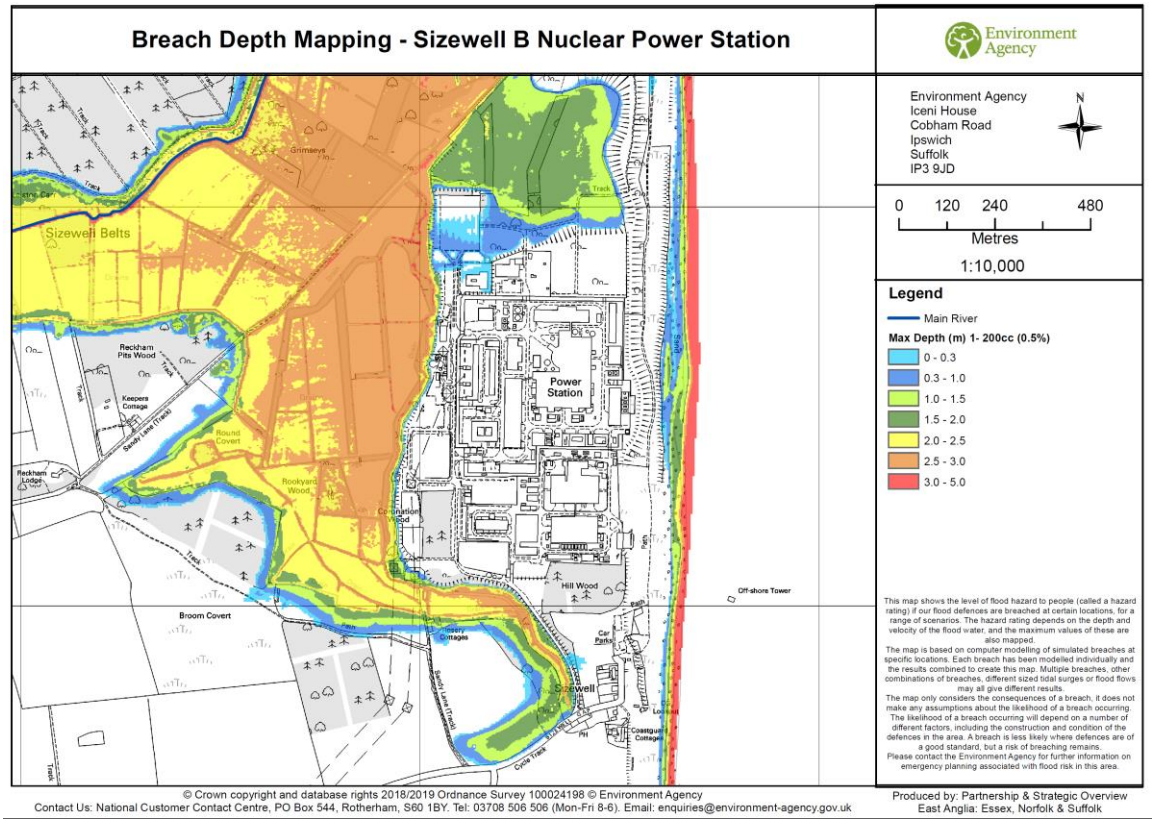


Figure 3-4: Breach depth mapping for the 1 in 200 year with climate change event



3.4.4 Both Coronation Wood and the area of Pillbox Field proposed for use as the Outage Car Park are shown to be located outside the extent for the modelled 1 in 200 year and 1 in 1,000 year breach events, both for the present day scenario and with climate change.

3.4.5 The Design and Access Statement Section 5.9 Outage Car Park (and Replacement Rosery Cottages Garage) notes that:

> *The proposed Outage Car Park design includes a 2-way vehicular access road along the southern extent of Sandy Lane from the Sizewell Gap public highway. This road will divert through into Pillbox Field on the western extent to link into the car parking area. As this portion of Sandy Lane is a public bridleway, consideration has been given to design modifications and operation around this area. Road junction improvements are proposed, from surfacing, to sightlines, to bridleway improvements.*

3.4.6 The proposed access into Pillbox Field will be via the existing track, i.e. along Sandy Lane, which is shown to be located outside the extent for the modelled 1 in 200 year breach event, both for the present day scenario and with climate change (Figure 3-3 and Figure 3-4).

3.4.7 Field 2 is located within an area at risk of flooding in the event of a tidal defence breach at the location Leiston 001 (Figure 3-3 and Figure 3-4) during the modelled 1 in 200 year breach event, both for the present day scenario and with climate change.

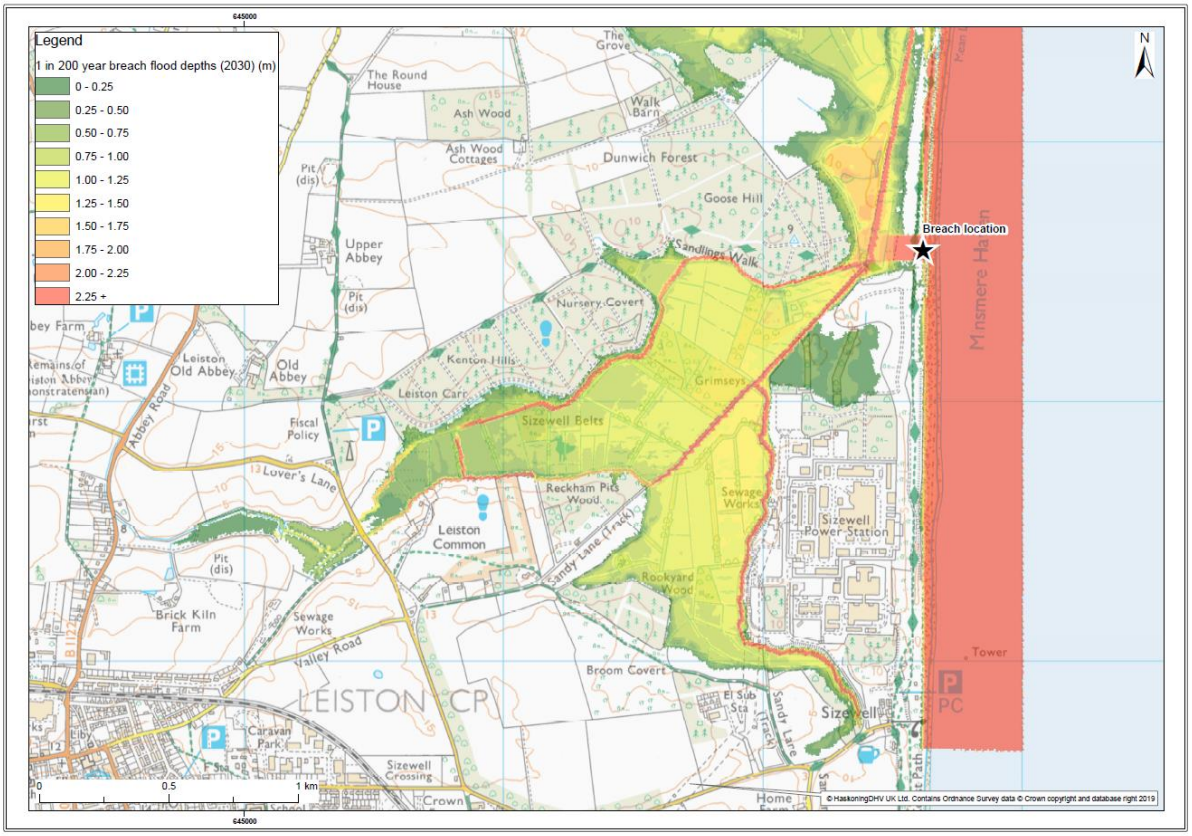
3.4.8 The modelled water depths and hazard ratings from the data provided by the Environment Agency form the basis of the initial breach flood risk analysis presented in Table 3-2 for all three site areas.

3.4.9 Breach modelling has been undertaken as part of the wider Sizewell C project, including a breach in the frontage in proximity to the site. This has been located at an area locally known as the tank traps. It provides further details into potential breach flood risk at the three development areas of the site.

3.4.10 The additional breach modelling utilises an alternative breach location that is geographically closer to the site than the Environment Agency's breach modelling, and therefore provides a more conservative approach to potential breach hazard. The results of the additional breach modelling have been discussed in the following sections of this addendum and are in addition to the information in the FRA.

3.4.11 During the modelled 1 in 200 year 2030 event, i.e. including climate change, flood depths were shown to be a maximum depth of 0.3m at Field 2 and a maximum flood depth of approximately 0.4m at the southernmost extent of Pillbox Field (although the flood extent does not affect the area proposed for the outage car park itself). The additional breach modelling also shows Coronation Wood to be outside the modelled breach flood extent (Figure 3-5).

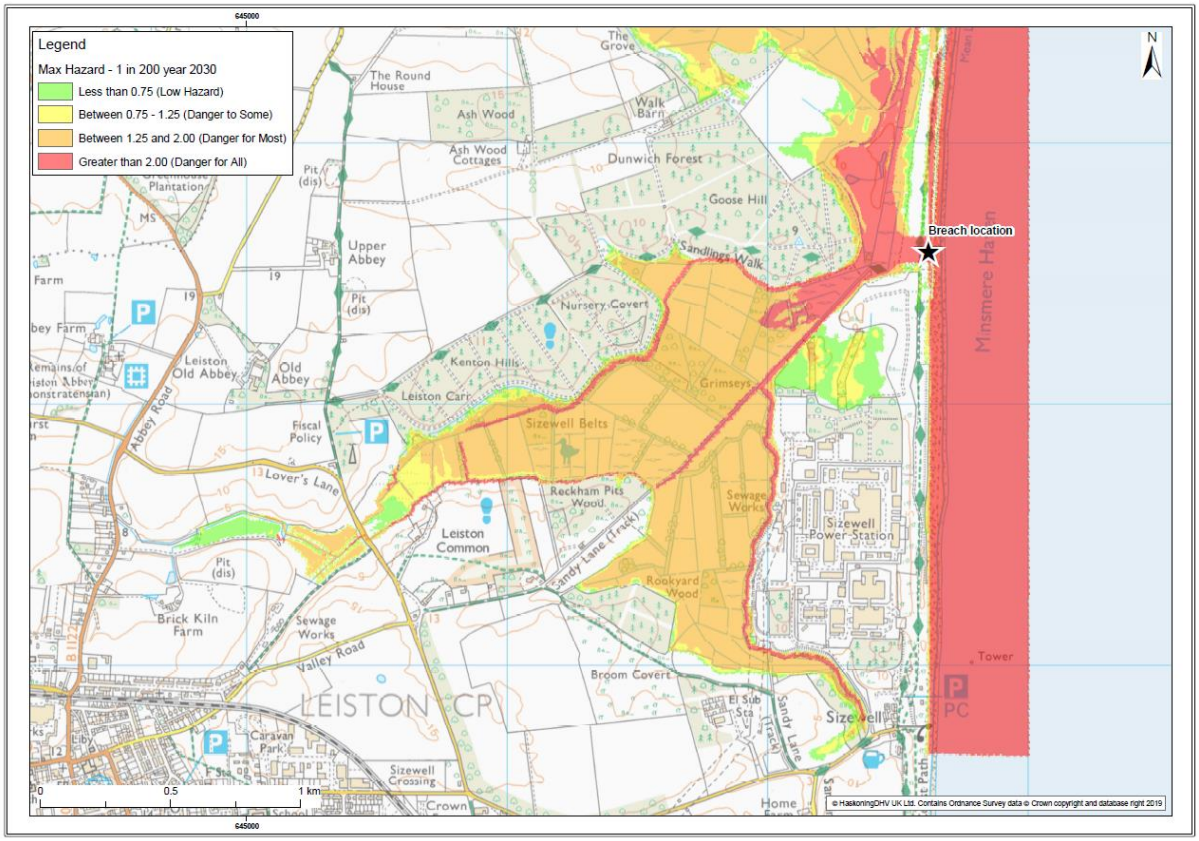
Figure 3-5: Breach depth mapping for the 1 in 200 year 2030 event



3.4.12 The hazard rating map for the 1 in 200 year breach event in 2030 shows that much of Field 2 is classed as being “Low Hazard” across a large proportion of the area, with some areas experiencing a hazard rating of up to 1.25 (i.e. Danger to Some) around the boundaries of Field 2 (Figure 3-6). In terms of the flood hazard this is still a relatively low risk which can be addressed through the review and update, as appropriate, of the existing Sizewell B flood emergency plan, to consider vehicles and personnel in this location during construction. As Field 2 is to be used for the storage of soil only and it is proposed that no other building materials will be located in Field 2, then the hazard during a breach would be limited to those using this area during the construction phase only.

3.4.13 The hazard rating map for the 1 in 200 year breach event in 2030 shows that much of Pillbox Field is outside the extent of the breach modelling. However, around the eastern and southern boundary of Pillbox Field (i.e. outside the area proposed for the outage car park) there is a maximum hazard rating of up to 1.25 (i.e. Danger to Some) as shown on Figure 3-6.

Figure 3-6: Breach hazard mapping for the 1 in 200 year 2030 event



3.5 Emergency & Evacuation Plan

3.5.1 The Environment Agency has stated that the development will require an evacuation plan which should deal with matters of:

- flood warning;
- evacuation and refuge;
- demonstrate that people will not be exposed to flood hazards;
- allow for safe movement of vehicles away from the Pillbox Field car park; and
- include a plan for the removal or safeguarding of materials in Field 2.

3.5.2 The proposed development is for changes and extension to the existing Sizewell B site. The changes to the site, as part of the proposed development, should therefore be reviewed and reflected within the site's existing flood emergency plan i.e. within the existing Sizewell B flood emergency plan.

3.5.3 The existing Sizewell B Non-Nuclear Emergency Handbook SZB (NNEM HBK SEC 4 SZB ISSUE 014) contains Section 4 Actions During Severe Weather, which includes information on flooding. This section was last updated in February 2019 and details the actions that site users should take for a number of weather and flood related events.

3.5.4 In the event of any flood or severe weather warnings being issued warnings shall be discussed and appropriate notification to site users shall be provided. There are separate procedures and actions related to flood risk from tidal surges as well as specific actions related to extreme rainfall.

3.5.5 Staff will be requested to be on the alert for flooding and patrols to potentially sensitive plant areas will be established. The Non-Nuclear Emergency Handbook also sets out guidelines and procedures as to when it would be necessary to consider deploying the station dam board protection system.

3.5.6 A detailed set of procedures is available should flooding pose a real threat to continued safe operation of the plant which includes shutdown of the reactor plant, summoning of Suffolk Fire Service and the evacuation of non-essential personnel. A detailed plan for extreme rainfall events is also available.

3.5.7 Area specific flood emergency plans for the proposed Sizewell B relocated facilities shall be considered and included or revised within the existing Sizewell B Non-Nuclear Emergency Handbook, as necessary. It is acknowledged that a review and update to the existing Sizewell B Non-Nuclear Emergency Handbook will be needed for the proposed Sizewell B relocated facilities in accordance with the requirements of the Nuclear Site Licence. The contents of the updates to the flood emergency plan will need to be agreed with the relevant risk management authorities at that time.

3.5.8 As noted in paragraph 3.4.12, the use of Field 2 is to be restricted to the storage of soil only and it is proposed that no other building materials will be located within this area. Therefore, there would be no requirement for the safeguarding of building materials within Field 2. On this basis the existing Sizewell B Non-Nuclear Emergency Handbook should be amended to include appropriate actions related to the evacuation of vehicles and personnel away from the outage car park in Pillbox Field and Field 2 (specifically during construction).

3.5.9 Should an alternative area be needed for material storage within Flood Zone 3a during construction, a plan for the safe removal or safeguarding of materials during a flood event would need to be included in the contractor's CEMP, as referenced in paragraph 5.11.1 of the Outline CEMP. In addition, it is acknowledged that if there were a need for material storage within Flood Zone 3a this shall be agreed with the Environment Agency, as part of the Environmental Permitting (England and Wales) (Amendment) (No. 2) Regulations 2018 process at that time.

3.5.10 However, on the basis that other areas (excluding Pillbox Field and Field 2) identified for the Sizewell B relocated facilities are predominantly outside the flood zone the above requirement is considered unlikely.

4. Clarification information related to lifetime of the development

4.1 Summary of Environment Agency comments

4.1.1 The Environment Agency seek clarification as to the lifetime of the development and the length of the planning permission sought.

4.1.2 The Environment Agency stated that the impact of flood risk has not been assessed, should the alterative end-state scenario go ahead.

4.1.3 The Environment Agency also note that the implications of ground raising on flood risk elsewhere is not assessed within the FRA up to 2055.

4.2 Lifetime of the development

4.2.1 Clarification as to the lifetime of the development has been addressed outside of this addendum due to its planning rather than flood risk nature. However, it is confirmed that Sizewell B power station is expected to operate until 2035, with the potential for a lifetime extension for 20 years to 2055.

4.2.2 The Environmental Statement Non-Technical Summary Section 5.4 notes that:

> *"The location of the Proposed Development has been largely determined by the location of the Sizewell B power station, as the facilities to be relocated are required to be in a relatively close proximity to the existing Sizewell B power station to ensure safe, secure and efficient working practices. However, since the commencement of the design process in 2012, a range of studies have taken place to explore which facilities require relocation, optimal sites for relocation and the design of the new facilities."*

4.2.3 The proposed relocated facilities, comprising the current planning application, have a 25 year design life as per the design requirements and in line with the Sizewell B Power Station current operating licence to 2035.

4.2.4 The design and the design life of these assets has been selected to support the current planned operation of the site. It is recognised that there is potential for future changes in the operational life of the site (i.e. an extension to the site licence) and these would be likely to require changes to the configuration of these assets which would be reflected at a future stage associated with any approved extension.

4.3 Clarification information about the alternative end-state scenario

4.3.1 The Environmental Statement (ES) Non-Technical Summary Section 5.3 notes that:

"The Proposed Development provides the opportunity to upgrade and create better working environments across facilities associated with Sizewell B power station and enables an earlier delivery of Sizewell C power station. Therefore, two development scenarios have been proposed and assessed within the ES.

The first scenario, the Base Scenario, assumes that the Sizewell C Project development consent application is granted and implemented. The second scenario, the Alternative End State Scenario, assumes that Sizewell C power station is neither consented nor implemented within the timescale agreed by East Suffolk Council."

4.3.2 The Environmental Statement (ES) Chapter 3 also notes that:

"The Proposed Development has been designed to accommodate two potential end state scenarios, with the 'base scenario' assuming that the proposed Sizewell C power station is consented and implemented and 'alternative end state' assuming that the Sizewell C power station application is not consented.

In the 'base scenario', the Proposed Development would be completely built out and the area of land that is nominated for Sizewell C, to the north of Sizewell B, would be left ready for future development.

In the 'alternative end state', the Phase Two works (as described above) would not be progressed. The majority of the Phase One construction and development work would be built out, with the exception of the replacement of the existing Outage Car Park to the north of Sizewell B station with the Outage Car Park at Pillbox Field. The area to the north of Sizewell B would be restored and landscaped in accordance with the Landscape Restoration Plan."

4.3.3 It is understood that the alternative end-state scenario would result in the restoration and landscaping of Field 2 and as a result topographic levels are likely to be permanently raised by 0.8m over the existing ground levels and this has been discussed further in Section 0.

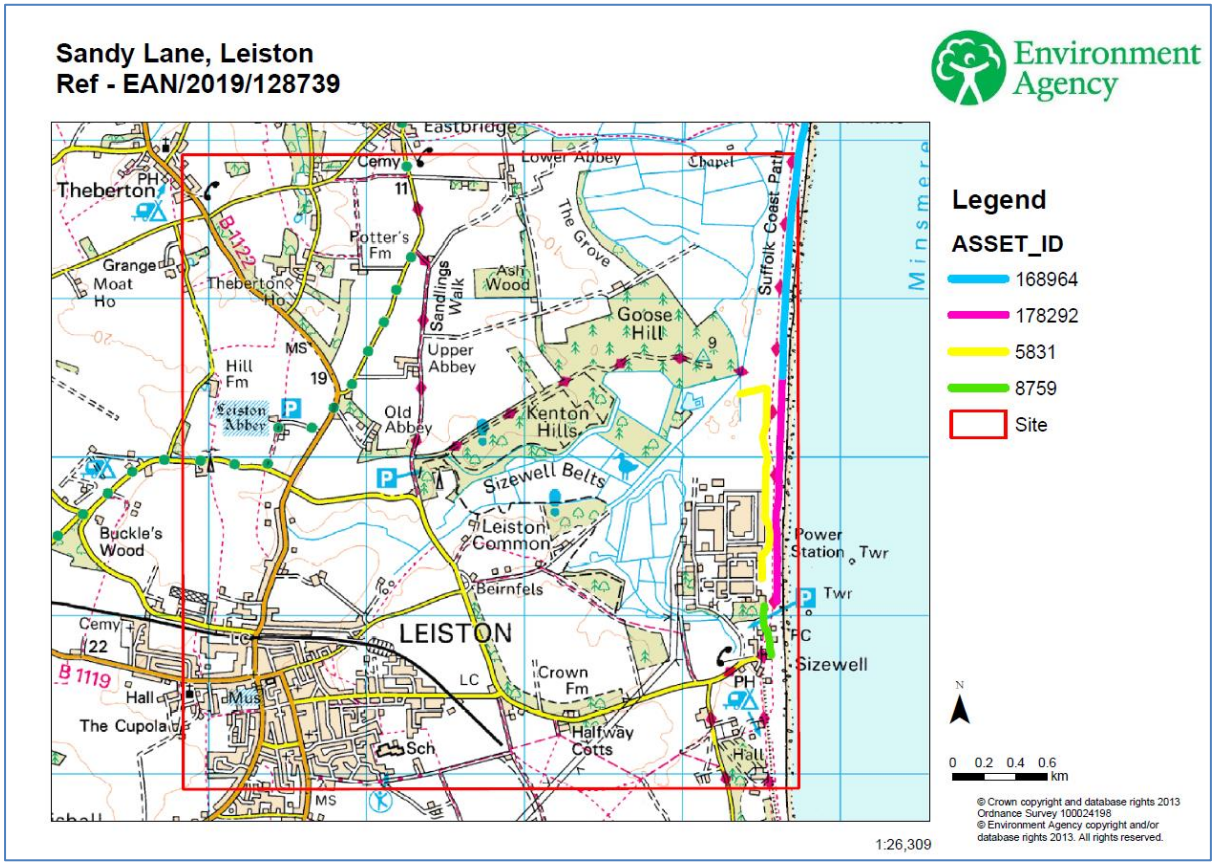
4.3.4 However, it is also recognised that there is potential for an extension to the site licence and that any changes may require changes to the configuration of the relocated facilities / assets which would be reflected at a future stage associated with any approved extension.

4.4 Clarification about implications of ground raising, up to 2055

4.4.1 Permanent ground raising associated with the alternative end state scenario would be limited to Field 2, with ground levels raised by approximately 0.8m compared with the existing levels.

4.4.2 Field 2 is located within an area which benefits from coastal flood defences, as demonstrated in the asset map shown in Figure 4-1 and the presence of both undefended and defended modelled scenarios. Field 2 has been confirmed in Section 3.2 of this addendum as being located outside of the modelled defended tidal flood extent. Therefore, the risk of tidal flooding posed to Field 2 is considered a residual risk.

Figure 4-1: Asset plan in Sizewell B Power Station area showing coastal defences



4.4.3 Field 2 has been confirmed in Section 3.4 and to be affected by a small area of breach flooding during the present day 1 in 200 year event at the current topographic levels. Modelling undertaken by the Environment Agency predicts flood depths during this event to be between 0m and 0.25m, while site-specific breach modelling undertaken to support the Sizewell C project predicts depths of 0.3m. The Environment Agency's breach modelling predicts flood depths of between 0.25m and 1.00m during the 1 in 1,000 year present day breach event and between 1.5m and 2.0m during the 1 in 200 year with climate change scenario (not accounting for any change in ground levels as part of the alternative end-state scenario).

4.4.4 Raising ground levels across Field 2 would therefore result in the displacement of the breach flood waters. An assessment of the volume of water likely to be displaced from Field 2 has been carried out for the 1 in 200 year with climate change scenario. The displaced volume of water has been added to the wider area that is likely to be inundated during the 1 in 200 year tidal breach event (e.g. encompassing Minsmere South Levels and Sizewell Belts and Marshes) to identify the relative increase in flood depth as a result of the displacement of flood water from Field 2.

4.4.5 A conservative approach has been adopted within the calculation as it is assumed that the maximum depth of 0.8m of flood water for the whole of the stockpile area within Field 2 would be displaced, ignoring any variation in either ground levels or flood depths (i.e. it has been assumed that the whole stockpile would be inundated in order to provide a maximum worst-case displacement volume). The results of the displacement calculations are summarised in Table 4-1.

Table 4-1: Summary of displacement of flood water during the 1in 200 year with climate change scenario

Site area	Area (ha)	Area (m^2)	Volume (m^3)	Displaced Water Depth (m)
Field 2	2.6	26,060	20,848	0.8000
Wider Flood Extent	762.9	7,629,009	-	0.003

4.4.6 The calculations show that the flood water displaced from Field 2 comprises a volume of 20,848m^3. When this additional volume of water is added to the wider flood extent, this would result in an increase in flood depth of approximately 0.003m (i.e. 3mm) which is a negligible change when taking into account modelling tolerances and the conservative approach adopted.

4.4.7 Due to the residual nature of the breach flood risk and the negligible change in depth of flood water across the wider area, which is already at risk of flooding during a breach event, it is confirmed that the impact of the displacement of flood water, taking into account climate change, is not considered to be significant.

4.4.8 Under the guidance set out in the National Planning Policy Framework flood compensatory storage is not required for residual flood risk and the proposed development within Field 2, as part of the alternative end-state scenario, does not result in a detrimental off-site impact.

5. Clarification on additional comments from Technical Appendix

5.1 Tidal undefended climate change levels

5.1.1 The Environment Agency notes that Table 5-3 titled "Undefended modelled tidal water levels with climate change" incorrectly presents present day modelled water levels. This error is acknowledged and Table 5-1 supersedes Table 5-3 of the FRA.

Table 5-1: Undefended modelled tidal water levels with climate change

	Undefended - modelled water level (mAOD)	
	1 in 200 year with climate change	1 in 1,000 year with climate change
Field 2	4.29	4.68
Pillbox Field	4.3	4.69
Coronation Wood	4.3	4.69

5.2 Flood risk activity permits

5.2.1 The Environment Agency noted that within Section 5.1.32 of the FRA it suggests that temporary storage and / or bunds could be put in place to protect the sites from tidal flooding, however no further detail is provided.

5.2.2 In Section 5.1.32 the FRA states that:

> *"Should an area be needed for material storage within Flood Zone 3a it is acknowledged that during the construction stage a plan of evacuation / safe removal of materials / safeguarding materials during a flood event will be required.*
>
> *Bunds could be put in place to safeguard the area should there be overtopping or a breach in the defences resulting in flooding, however, this would need to show that any flow paths are not altered and flood risk is not increased".*

5.2.3 In accordance with Paragraph 3.5.9, this FRA Addendum notes that there are no proposals to store building materials within Flood Zone 3a and therefore no bunds are proposed as part of the application. In accordance with Paragraph 3.5.9, if an area is needed for material storage within Flood Zone 3a a plan for the safe removal or safeguarding of materials during a flood event would need to be included in the contractor's CEMP, as referenced in paragraph 5.11.1 of the Outline CEMP. It is acknowledged that if there were a need for material storage within Flood Zone 3a this shall be agreed with the Environment Agency, as part of the Environmental

Permitting (England and Wales) (Amendment) (No. 2) Regulations 2018 process at that time.

5.2.4 Further to the above, the Environment Agency sets out additional requirements related to a flood risk activity permit. However, it is currently anticipated that this would be limited to works either crossing over or in proximity to a watercourse, as set out in the following section.

5.3 Permits and consents for watercourse crossings

5.3.1 We acknowledge that any works, either temporary or permanent, which change the flow of water along a watercourse or require the erection of a culvert, bridge or modification to the channel require consent from the relevant authorities. This is applicable to any activity within 8m of the bank of a main river, any flood defence structure or culvert on a main river, or within 16m of a tidal river or sea defence structure.

5.3.2 The methodology to be used for any temporary or permanent construction at crossing points over existing ditches and watercourses shall be agreed with the Environment Agency, Lead Local Flood Authority or IDB, as appropriate, as part of the Environmental Permitting (England and Wales) (Amendment) (No. 2) Regulations 2018 process or as an Ordinary Watercourse Consent application.

5.4 Vulnerability classification

5.4.1 The Environment Agency has stated that;

"According to Table 2: Flood Risk Vulnerability Classification of the Planning Practice Guidance (PPG) Sizewell B power station is classified as essential infrastructure".

5.4.2 Three types of development are considered "Essential Infrastructure" within the PPG;

- essential transport infrastructure;
- essential utility infrastructure (including electricity generating power stations, grid and primary substations and water treatment works); and
- wind turbines.

5.4.3 The area within the red line boundary incorporates developed and undeveloped land. The developed land comprises a series of supporting services and infrastructure for Sizewell B but it does not include electricity generating elements. The proposed development is limited to the relocation of supporting infrastructure such as offices, car parking, storage and administrative buildings.

5.4.4 The nature of the proposed development is such that it can be classified as "Buildings used for professional services, general industry and storage and

distribution". Therefore, within PPG all of the above land uses are classified as "Less Vulnerable".

5.4.5 We have acknowledged in section 5.1.5 of the FRA that the Sizewell B power station itself would be classified as "Essential Infrastructure" under the PPG. However, there are no planned changes to the power generating aspects of the Sizewell B site as part of the current planning application and therefore the proposed development is "Less Vulnerable" in line with the PPG.

6. Conclusion

6.1.1 This Flood Risk Assessment Addendum aims to address the comments and concerns raised by the Environment Agency in their planning response letter dated 17th May 2019 (Ref: AE/2019/124070/01-L01). It provides clarity on key issues through the provision of further information to support the existing conclusions set out within the FRA. However, the conclusions of the FRA submitted with the planning application remain unchanged.

6.1.2 Further analysis of ground levels compared with the modelled water levels has shown that the flood risk to the site is a residual risk. Coronation Wood and Pillbox Field are shown to be located outside the extent for the modelled 1 in 200 year and 1 in 1,000 year breach events, both for the present day scenario and with climate change.

6.1.3 Flood risk to Field 2 has been reviewed during a breach event and the potential depths of flooding, during the present day 1 in 200 year event, are likely to be a maximum of 0.3m, based on current topographic levels. Additionally, the hazard rating map for the 1 in 200 year breach event in 2030 shows that much of Field 2 is classed as being “Low Hazard” across a large proportion of the area, with some areas experiencing a hazard rating of up to 1.25 (i.e. Danger to Some) however, this is limited to the boundaries of Field 2.

6.1.4 Flood depths modelled by the Environment Agency for the 1 in 200 year with climate change scenario are between 1.5m and 2.0m (not accounting for any change in ground levels as part of the alternative end-state scenario). Raising ground levels across Field 2 would result in the displacement of a maximum a volume of 20,848m^3 of the breach flood waters. When this is applied to the wider flood extent this would result in an increase in flood depth of approximately 0.003m (i.e. 3mm) which is considered to be a negligible change when taking into account modelling tolerances and the conservative approach adopted.

6.1.5 Further information is provided related to the existing Sizewell B Non-Nuclear Emergency Handbook. Area specific flood emergency plans for the proposed Sizewell B relocated facilities shall be considered and included, or revised, within the existing Sizewell B Non-Nuclear Emergency Handbook, as necessary. The existing Sizewell B Non-Nuclear Emergency Handbook should be amended to include appropriate actions related to the evacuation of vehicles and personnel away from the outage car park in Pillbox Field and Field 2 (specifically during construction).

APPENDIX 1A: ENVIRONMENT AGENCY PLANNING CONSULTEE RESPONSE, 17TH MAY 2019

[redacted]ouncil
Planning Department
East Suffolk House Station Road
Melton
Woodbridge
IP12 1RT

Our ref: AE/2019/124070/01-L01
Your ref: DC/19/1637/FUL

Date: 17 May 2019

Dear [redacted]

1. IN OUTLINE, COMPRISING A VISITOR CENTRE (MAXIMUM 2,000SQ.M GEA) AND A MAXIMUM OF 9,500SQ.M (GEA) OF FLOORSPACE TO PROVIDE ADMINISTRATION, STORAGE, WELFARE AND CANTEEN FACILITIES WITH ALL MATTERS RESERVED APART FROM ACCESS.
2. IN FULL, FOR THE DEMOLITION OF THE EXISTING OUTAGE STORE, LAYDOWN AREA, OPERATIONS TRAINING CENTRE, TECHNICAL TRAINING FACILITY, VISITOR CENTRE, AND ROSERY COTTAGE GARAGE; REMOVAL OF TECHNICAL TRAINING AND POOL CAR PARK (63 SPACES), CORONATION WOOD CAR PARK (21 SPACES), VISITOR CENTRE CAR PARK (16 SPACES) AND NORTHERN OUTAGE CAR PARK (576 SPACES); MEANTIME USE OF THE TECHNICAL TRAINING CENTRE AS AN INTERIM VISITOR CENTRE FOLLOWED BY ITS DEMOLITION; AND ERECTION OF NEW (ALL FLOORSPACE IN GEA) OUTAGE STORE (2,778SQ.M), LAYDOWN AREA (11,990SQ.M) INCLUDING NEW WESTERN ACCESS ROAD, YARDMAN'S OFFICE (23SQ.M), TRAINING CENTRE (4,032SQ.M), ROSERY COTTAGE GARAGE (30SQ.M), REPLACEMENT CAR PARK (2,363SQ.M) PROVIDING 112 SPACES, AND OUTAGE CAR PARK (15,525SQ.M) PROVIDING (576 SPACES) INCLUDING NEW ACCESS ROAD (AND ALTERNATIVE ACCESS TO BRIDLEWAY), FOOTPATH AND AMENDED JUNCTION AT SIZEWELL GAP; AND ASSOCIATED LANDSCAPING EARTHWORKS/RECONTOURING, TREE FELLING AND BOUNDARY TREATMENT.

SIZEWELL B POWER STATION COMPLEX AND ADJOINING LAND, SIZEWELL POWER STATION ROAD, SIZEWELL, LEISTON, SUFFOLK, IP16 4UR

Thank you for your consultation dated 25 April 2019. We have reviewed the application as submitted and are raising a holding objection on Flood Risk grounds as outlined within the Flood Risk section below. We have also included advice on Ecology, Groundwater & Contaminated Land, COMAH Regulations, Waste and the Water Framework Directive.

Flood Risk

We are raising a holding objection on Flood Risk grounds. Our maps show the site lies

within fluvial & tidal Flood Zones 1, 2 and 3a, defined by the 'Planning Practice Guidance: Flood Risk and Coastal Change' as having a low, medium and high probability of flooding respectively. The proposal is for the relocation of a number of existing facilities ancillary to the operation of the Sizewell B Power Station. This will involve the construction of replacement facilities at Sizewell B followed by demolition of the existing facilities in order to release land for Sizewell C.

The majority of this work has been sequentially sited and is located in Flood Zone 1. However the areas known as 'Field 2' and 'Pillbox Field' fall within Flood Zone 3a. Field 2 will be used to stockpile material and the Pillbox Field will be used as a car park. The access roads and footpaths to the proposed car park also fall within Flood Zone 3a. New footbridges will be constructed for pedestrian access over the Sizewell drain which is an ordinary watercourse.

According to Table 2: Flood Risk Vulnerability Classification of the Planning Practice Guidance (PPG) Sizewell B power station is classified as 'essential infrastructure'. However section 5.1.6 of the submitted Flood Risk Assessment (FRA) states that the proposed development should be considered as 'less vulnerable' development, as the proposed development in this application does not include work to the electricity generating element of the site. The Local Council should determine whether this vulnerability classification is appropriate. Should the proposal be considered essential infrastructure we would wish to re consulted as this will change the FRA requirements such as the climate change allowances applied. Essential infrastructure must also be designed and constructed to remain operational and safe in times of flood if located in Flood Zone 3a.

To comply with national policy the application is required to pass the Sequential and Exception Tests and be supported by a site specific FRA.
We have reviewed the submitted FRA located in Appendix 14.1 of the Sizewell B Relocated Facilities Environmental Statement, dated April 2019, and require further information in order to fully understand and assess the flood risks arising from the proposed development. We require the following information in order to make a decision on this application:

1. Provide a GPS verified topographic survey

2. Provide information on mitigation measures to manage the residual risk of a breach flood. The requirement for flood emergency planning including flood warning and evacuation of people has not be discussed in the FRA.

3. Confirm the lifetime of the development and therefore the length of planning permission being sought. Should the stockpile area located on Field 2 be located there permanently beyond 2055 how will flood risk be assessed and managed?

Overcoming our Objection

The applicant can overcome our objection by submitting an FRA and/or further information that covers the issues highlighted above. We elaborate and provide further advice on these points below.

1. GPS verified topographic survey

Section 3.1.6 & 3.1.7 of the FRA suggests that the site levels used within the FRA are derived from Lidar but this may not be accurate due to tree coverage in the area. The

levels do not appear to have been derived from a GPS verified topographic survey as requested in our previous pre-application advice dated 14 November 2016 and detailed in row 6 of table 14.2 in Chapter 14 of the Sizewell B Relocated Facilities Environmental Statement: Surface Water and Flood Risk, dated April 2019. A GPS verified topographic survey is a standard requirement of an FRA to ensure the site levels used and flood depths calculated are accurate.

2. Mitigation

It is agreed that although the Pillbox Field and Field 2 are shown to be in Flood Zone 3a they are not at actual risk of flooding when the tidal defences are considered. The Environment Agency's flood map for planning and flood zones do not consider the benefit of defences and shows a completely undefended scenario. The sites benefit from tidal sea defences which protect the Pillbox Field and Field 2 up to the extreme 0.1% (1 in 1000) annual probability event including an allowance for climate change. The fluvial flood modelling, specifically the flood outlines, show that the sites are not at risk in the extreme 0.1% (1 in 1000) annual probability event. This should be confirmed by comparing a GPS verified topographic survey with the flood levels detailed in the FRA.

The FRA correctly identifies that although the sites are not at actual risk of flooding there is a residual risk of a failure of the flood defences which is assessed in section 6. During pre-application discussions with the applicant, namely a telephone conference call on 28 February 2019, we understood that this residual breach risk would be managed with various mitigation measures.

This included an evacuation plan which would allow for safe movement of vehicles away from the Pillbox Field car park and a plan for the removal or safeguarding of materials in Field 2. The applicant should also consider what site users should do before, during and after a flood. These measures are not detailed in the FRA and flood warning and evacuation are not discussed in detail.

Where safe access cannot be achieved, or if the development would be at residual risk of flooding in a breach, an emergency flood plan that deals with matters of evacuation and refuge should demonstrate that people will not be exposed to flood hazards. The emergency flood plan should be submitted or conditioned as part of the FRA and will need to be agreed with the Local Council. Please confirm that a flood warning and evacuation plan or emergency flood plan will be produced.

3. Lifetime beyond 2055

Section 5.1.20 of the FRA states that the lifetime of the proposed developments is until 2055 which is a lifetime of 36 years. It should be confirmed if this is the length of the planning permission being sought as well, i.e. will the planning permission end in 2055? Section 3.1.18 of the FRA states that there is an alternate end-state scenario should the Sizewell C power station not go ahead. This would mean that the stockpiles would be retained beyond 2055 as the permanent landscaping and ground levels could be raised by 0.8m permanently. The impact of this upon flood risk has not been assessed. This land raising has the potential to divert breach flood waters elsewhere. It is noted that the current day design breach event (0.5% annual probability/1 in 200 year event) does impact the site to some extent so the impact elsewhere may be small. When climate change is considered over 100 years the site is entirely covered by flood water. In this event the access road from the Pillbox field is also flooded.

The FRA does not discuss the implications of the ground raising on flood risk elsewhere up to 2055. It is understood from previous pre-application correspondence that this would not have an impact but no justification has been provided in the FRA. Should Sizewell C not go ahead will the flood risk implications beyond 2055 be assessed at a later date under a separate planning permission?

We provide further advice for the applicant in the Flood Risk Technical Appendix located at the end of this letter. We ask to be re-consulted with the results of the updated FRA/new information. We will provide you with bespoke comments within 21 days of receiving formal re-consultation. Our objection will be maintained until an adequate FRA has been submitted.

If you are minded to approve the application contrary to this advice, we request that you contact us to allow further discussion and/or representations from us in line with the Town and Country Planning (Consultation) (England) Direction 2009.

Ecology

We have no objections to this application on ecology grounds. However, following consideration of the submitted documentation we but have specified some areas requiring review. These have been laid out below in the same format of the submitted docuementation.

Chapter 14: Surface Water and Flood Risk

We welcome the strategies identified to manage surface runoff though SuDS and sediment traps to limit the effects on the receiving water course.
With regard to the pedestrian access bridges, the proposed design minimises direct interaction with the ecology, hydrology and geomorphology of the channel which is likely to produce the best outcome where a bridge is required.

Chapter 6: Terrestrial Ecology

The loss of existing habitat can be acceptable where sufficient resource is invested into re-establishing new habitat and enhancing habitat that remains. The proposal specifies multiple ways in which mitigation measures could be implemented through replanting but this will take a number of years to develop. The natural habitat losses stated in paragraph 6.6.37 may exceed biodiversity gain. We highlight the responsibility to 'minimise impacts on and provide net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures' (National Planning Policy Framework section 15: 170c).
We encourage long term active monitoring, as stated in section 6.7c, of the implemented mitigation and surface water collection systems to ensure measures are effective and successful.
We note Himalayan Balsam (listed on Schedule 9 of the Wildlife and Countryside Act) was identified on site and must be managed accordingly to remove and prevent spread.

Chapter 16: Cumulative Impacts

We make note that cumulative impacts are possible upon terrestrial ecology and ornithology during construction stages in combination with the proposed development of Sizewell C, SPR EA1N and EA2 despite the proposals being at various stages. This reinforces the important of creating, enhancing and maintaining sufficient habitat and biodiversity that is resilient to future pressures as specified in the National Planning

Policy Framework (Section 15).

Groundwater and Contaminated Land

Chapter 12: Land Quality

Generally we agree with the findings of EIA Chapter 12 – Land Quality. However, we note the review of previous reports refers only to soil data and comparison with Human health criteria (12.4.45, 12.4.50, 12.4.58, 12.4.63). It would be useful if it was confirmed whether groundwater quality data is available and what GAC (general assessment criteria) were used to assess the results.

Control of Major Accident Hazards Regulations 2015 (COMAH)

The facility is regulated by the Environment Agency's Nuclear Regulation team under a Radioactive Substances and Environmental (Installation) permit. These permits do not require modification as a result of this planning application.

The facility is also notified in accordance with the Control of Major Accident Hazards Regulations 2015 (COMAH) as an Upper Tier establishment.
COMAH establishments are regulated by the COMAH Competent Authority (Environment Agency and the Health & Safety Executive (HSE), or in relation to a nuclear establishment the Office for Nuclear Regulation (ONR), acting jointly). It is recommended that the planning authority consult the ONR (and HSE if appropriate) on the planning application.

Waste

Duty of Care regulations

The Environmental Protection (Duty of Care) Regulations 1991 for dealing with waste materials are applicable to any off-site movements of wastes.

The code of practice applies to you if you produce, carry, keep, dispose of, treat, import or have control of waste in England or Wales.

The law requires anyone dealing with waste to keep it safe and make sure it's dealt with responsibly and only given to businesses authorised to take it. The code of practice can be found here:
https://www.gov.uk//uploads/system/uploads/attachment_data///waste-duty-care-code-practice-2016.pdf

If you need to register as a carrier of waste, please follow the instructions here:
https://www.gov.uk/register-as-a-waste-carrier-broker-or-dealer-wales

If you require any local advice or guidance please contact your local Environment Agency office:

Waste Framework Directive

If materials that are potentially waste are to be used on-site, the applicant will need to ensure they can comply with the exclusion from the Waste Framework Directive (WFD) (article 2(1) (c)) for the use of, 'uncontaminated soil and other naturally occurring material excavated in the course of construction activities, etc…' in order for the

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material not to be considered as waste. Meeting these criteria will mean waste permitting requirements do not apply.

Where the applicant cannot meet the criteria, they will be required to obtain the appropriate waste permit or exemption from us

A deposit of waste to land will either be a disposal or a recovery activity. The legal test for recovery is set out in Article 3(15) of WFD as:

- any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.
- We have produced guidance on the recovery test which can be viewed at https://www.gov.uk/guidance/waste-recovery-plans-and-permits#waste-recovery-activities.

You can find more information on the Waste Framework Directive here: https://www.gov.uk/government/publications/environmental-permitting-guidance-the-waste-framework-directive

More information on the definition of waste can be found here: https://www.gov.uk/government/publications/legal-definition-of-waste-guidance

More information on the use of waste in exempt activities can be found here: https://www.gov.uk/government/collections/waste-exemptions-using-waste

Non-waste activities are not regulated by us (i.e. activities carried out under the CL:ARE Code of Practice), however you will need to decide if materials meet End of Waste or By-products criteria (as defined by the WFD). The 'Is it waste' tool, allows you to make an assessment and can be found here: https://www.gov.uk/government/publications/isitwaste-tool-for-advice-on-the-by-products-and-end-of-waste-tests

If you require any local advice or guidance please contact your local Environment Agency office: Ipswich Waste 02030257772

Waste Hierachy

The developer must apply the waste hierarchy as a priority order of prevention, re-use, recycling before considering other recovery or disposal options. Government guidance on the waste hierarchy in England can be found here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69403/pb13530-waste-hierarchy-guidance.pdf

Circular Economy

The circular economy is a concept designed to keep materials in use as long as possible, thus promoting resource efficient practice and deriving economic benefits. Adherence to the waste hierarchy and adoption of best practice in relation to site waste management planning will help you deliver against circular economy objectives.

Observance of the waste hierarchy objectives and principles of the circular economy will depend upon the selection of the most sustainable option at every phase of a development project, from reduction through design and architecture, to the selection of

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the most efficient recovery process for the treatment and use of waste.

Management of Waste

Where a development involves any significant construction or related activities, we would recommend using a management and reporting system to minimise and track the fate of construction wastes, such as that set out in PAS402: 2013, or an appropriate equivalent assurance methodology. This should ensure that any waste contractors employed are suitably responsible in ensuring waste only goes to legitimate destinations.

Water Framework Directive

We are pleased to see statements relating to our previous concerns within the application. We are satisfied the control measures outlined within the Water Framework Directive compliance assessment will be sufficient to prevent detrimental effects on surface waters.

We trust this advice is useful.

Yours sincerely

[redacted]

[redacted]
Sustainable Places - Planning Advisor

Direct dial [redacted]
Direct e-mail [redacted]

Flood Risk Technical Appendix

During our review of the FRA we noted the following points which you should be aware of:

Tidal Undefended Climate Change Levels

The modelled flood levels detailed in Table 5-3 do not consider climate change. The levels shown are the current day flood levels. The undefended modelled flood levels are shown in the Environment Agency Product 8 data in Appendix 1A of the FRA.

Risk of Flooding from Reservoirs

This application site is at risk from reservoir flooding. The FRA states that the risk of flooding from reservoirs is low. Reservoir flooding is extremely unlikely to happen providing the reservoir is appropriately managed and maintained. All large raised reservoirs designated as 'high-risk' and those where the risk is still to be determined must be inspected and supervised by reservoir panel engineers. The Environment Agency are the enforcement authority for the Reservoirs Act 1975 and under this Act it is a requirement that reservoirs are inspected regularly and essential safety work is carried out.

However, the failure of a reservoir has the potential to cause catastrophic damage due to the sudden release of large volumes of water with little or no warning. The local planning authority will need to evaluate the potential damage to buildings or loss of life in the event of dam failure, compared to other risks, when considering development downstream of a reservoir. The reservoir failure flood extent cuts across the access road to the Pillbox Field car park so this should be considered in any flood warning and evacuation plan.

The Planning Practice Guidance states that Local planning authorities are advised to consult with their emergency planning officers as early as possible regarding any planning applications which have implications for emergency planning. Where issues affecting emergency services are identified it may be relevant to contact the local resilience forum which prepare for local incidents and catastrophic emergencies. Or in some cases, it may be appropriate for the local planning authority to consult the emergency services on specific emergency planning issues related to new developments. Local planning authorities are also advised to consult with the owners/operators of raised reservoirs, to establish constraints upon safe development.

Flood Risk Activity Permit – Temporary works/bunds

Section 5.1.32 of the FRA suggests that temporary storage and/or bunds could be put in place to protect the sites from tidal flooding however no further detail is provided. As we do not have the detailed design of these works particularly the bunds we cannot assess the implications this could have for flood risk elsewhere. It is not known where these bunds will be located. As the detail design is not available for the planning application further permission may be required should they be implemented.
Under the Environmental Permitting Regulations 2016 for England and Wales you may need an environmental permit for flood risk activities if they want to do work in, under, over or within 8 metres of a fluvial main river, flood defence structure or culvert or within 16m of a tidal main river, flood defence structure or culvert. Works on a floodplain such as the bunds discussed above may also require a flood risk activity permit. This is set out in the flood risk activity meaning below. Please note an allowed activity is an activity

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which has been granted planning permission.
(g) Any activity (other than an allowed activity) on a flood plain that is-
(i) more than 8 metres from a non-tidal main river or more than 16 metres from a tidal main river, or
(ii) more than 8 metres from any flood defence structure or culvert on a non-tidal main river or more than 16 metres from any flood defence structure or culvert on a tidal main river;
which is likely to divert or obstruct floodwaters, to damage any river control works or to affect drainage.
Application forms and further information can be found at:
https://www.gov.uk/guidance/flood-risk-activities-environmental-permits.

Ordinary Watercourse Consent

The proposal is located adjacent to Sizewell Drain an ordinary watercourse which falls under the jurisdiction of the East Suffolk Internal Drainage Board. It is understood that footbridges will be installed as part of this application. You may require consent from the IDB if you wish to undertake works on or near the watercourse.

Safe Access

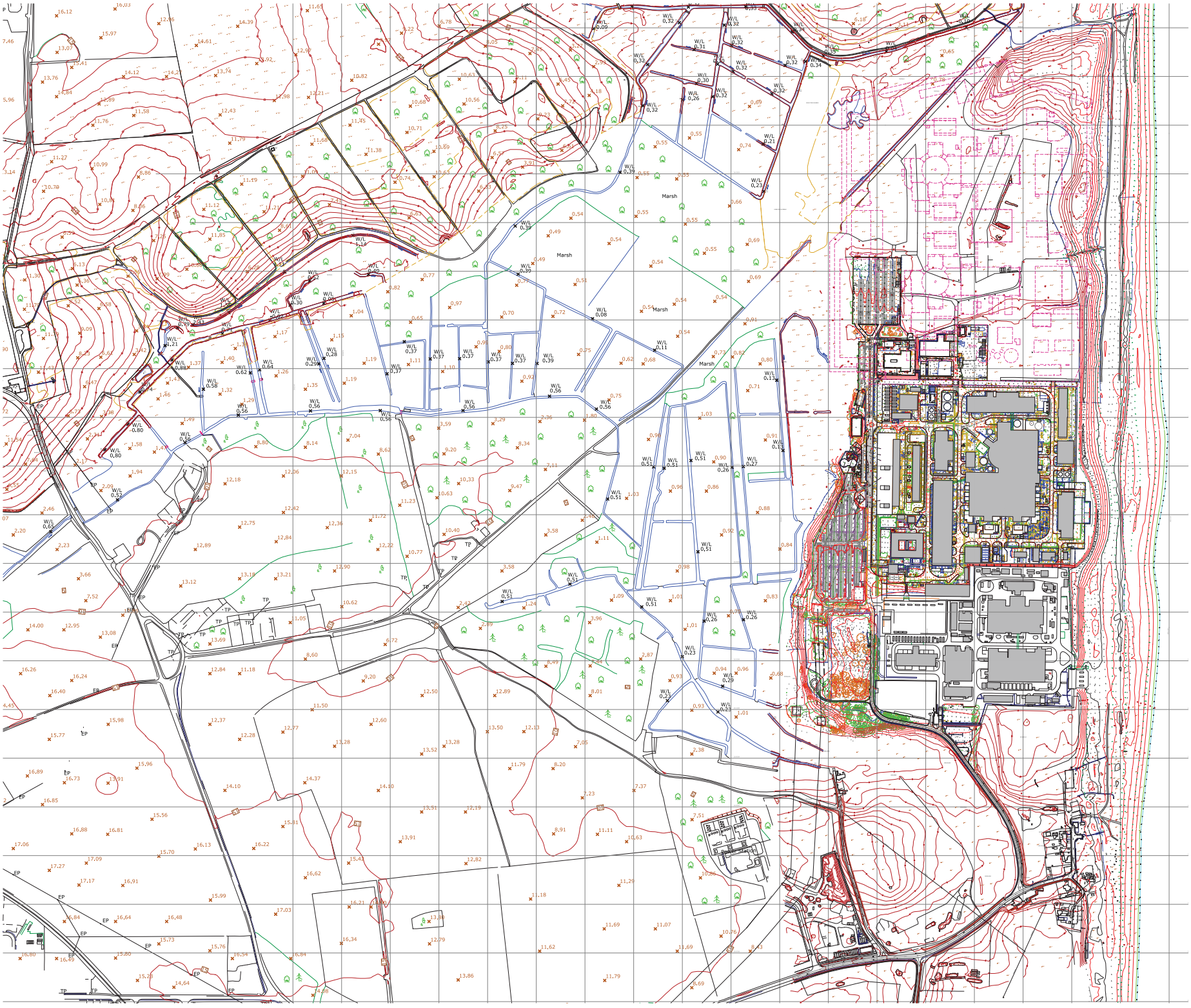
During a flood, the journey to safe, dry areas completely outside the 0.5% (1 in 200) annual probability event with climate change should not involve crossing areas of potentially fast flowing water. Those venturing out on foot in areas where flooding exceeds 100 millimetres or so would be at risk from a wide range of hazards, including for example unmarked drops, or access chambers where the cover has been swept away.
Safe access and egress routes should be assessed in accordance with the guidance document Defra/EA Technical Report FD2320: Flood Risk Assessment Guidance for New Development..
Where safe access cannot be achieved an emergency flood plan that deals with matters of evacuation and refuge should demonstrate that people will not be exposed to flood hazards. The emergency flood plan should be submitted as part of the FRA and will need to be agreed with yourselves.

Other Sources of Flooding

In addition to the above flood risk, the site may be within an area at risk of flooding from surface water, reservoirs, sewer and/or groundwater. We have not considered these risks in any detail, but you should ensure these risks are all considered fully before determining the application.

End

APPENDIX 1B: GPS VERIFIED TOPOGRAPHIC SURVEY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