Hornsea Project Four

Position Paper on Hydrology and Flood Risk - Assessment of Modelled Water Levels for Onshore Substation and Attenuation Feature

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Rev	*Page*	*Section*	*Description*
01	4 – 5, 19 - 22	Paragraph 2.1.6 – 2.1.9, Section 6 and Section 7 (references)	Text throughout the document has been updated to respond to EA's written comment RA/2021/143235/01-L01. This Position paper was originally issued to evidence plan members pre-application.

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1. Summary March 2022 update

1.1.1 This Position statement was originally submitted to Hydrology Evidence Plan Technical Panel members in March 2020. The content has been updated after correspondence with the Environment Agency on 28 June 2021 and 7th September 2021, and as such contains a mixture of old (2020) and new (2022) text.

2. Introduction

2.1.1 As part of the Development Consent Order (DCO) application for the proposed Hornsea Project Four Offshore Wind Farm Project (hereafter referred to as Hornsea Project Four) queries have been raised by the Environment Agency during Water and Flood Risk Evidence Plan Technical Panel Meetings held to date and the 2019 Section 42 consultation process in relation to the design of the platform and infrastructure associated with the Hornsea Project Four Onshore Substation (OnSS).

2.1.2 Following discussions and receipt of a briefing note from the Environment Agency entitled 'Flood risk and freeboard considerations around Creyke Beck OnSS' (Environment Agency, 2020), the Environment Agency's key concerns can be summarised as follows:

- Use of appropriate freeboard in relation to Hornsea Project Four OnSS and associated infrastructure; and
- Location of attenuation feature in Flood Zone 3 and therefore the potential for displacement of flood water in this area.

2.1.3 The Environment Agency has also acknowledged that there are uncertainties with their existing hydraulic modelling at the proposed Hornsea Project Four OnSS. The Environment Agency noted that a more detailed model had been carried out for the development at the adjacent National Grid Creyke Beck Onshore substation, which forms part of the Dogger Bank project. It is understood that this model was produced by Mott MacDonald. It was recommended that the information from this model was obtained to inform the Hornsea Project Four Flood Risk Assessment (FRA).

2.1.4 Following dialogue with National Grid, a copy of the report entitled 'National Grid Asset Flood Resilience DRAFT Flood Risk Assessment Creyke Beck 400 kV Substation National Grid' (Ref: PDD-30744-2-REP-121) (Mott MacDonald, 2016) has been provided. However, the detailed modelling files used to produce the report have not been made available. We have been advised that these will not be made available to Hornsea Project Four to inform the Hornsea Project Four Onshore Infrastructure Flood Risk Assessment (hereafter referred to as FRA) (**A6.2.2 Onshore Infrastructure Flood Risk Assessment (APP-098)**).

2.1.5 This document presents the information that has been used to summarise and inform our understanding of the flood risk in the area. A review of the available data demonstrates that there is limited flood risk to the proposed Hornsea Project Four OnSS and that it can be delivered in accordance with the principles set out in National Planning Policy Framework (NPPF) and its associated guidance, mitigating

the concerns previously raised by the Environment Agency through the Hornsea Four Water and Flood Risk Evidence Plan Technical Panel meetings on 5th November 2019 and 5th February 2020, in relation to flood risk in the area.

2.1.6 Further to the discussions above, and following an initial review of this Position Paper, the Environment Agency provided written correspondence, dated 28th June 2021 (Ref: RA/2021/143235/01-L01), with regards to data validity and Hornsea Four.

2.1.7 With reference to flood risk, the above correspondence noted the following:

> *"We agree with the conclusion that the geomorphology baseline data and Water Framework Directive data upon which the previous assessments have been based will still be relevant and will therefore remain valid until the revised submission date of September 2021.*
>
> *However, the following changes are relevant in regard to flood risk:*
>
> - *East Riding of Yorkshire Council published an updated Level 1 Strategic Flood Risk Assessment in late 2019, which now contains more information including the impacts of climate change (where known) and consideration of all sources of risk.*
> - *The published peak river flow allowances (https://www.gov.uk/guidance/floodrisk-assessments-climate-change-allowances) are due to be updated in July 2021. Based on a September 2021 submission, this will have to use the most up to date allowances. Please see the enclosed note for more information, including draft allowances.*
> - *There has been flooding in the East Yorkshire catchments in 2019/20 and also in 2020/21. It is advisable to check that this new information does not present any additional issues for the development.*
> - *Some updates to the Environment Agency's Flood Map for Planning have taken place. Where relevant, it is probably most useful to be aware of those changes and ensure their methodology and method(s) of work take that information into account.*
>
> *Please confirm the climate change allowances used in the Flood Risk Assessment for the substation element. The PEIR Vol. 6 Annex 22 Section 5 states that 20% peak river flow uplift was used as "the site is currently in FZ1." The Hydrology Position Paper (June 2021) states that more detailed modelling was incorporated from a 2016 Mott MacDonald study, which was agreed to be the most up to date modelling at the time.*
>
> *We recommend you to do some basic level checks against any changes since 2019 to confirm that this new (best available) information does not affect your work in any significant way and, that in light of the information, your works will not increase flood risk elsewhere."*

2.1.8 To provide a comprehensive assessment of the flood risk to Hornsea Project Four, this Position Paper has been updated to consider the comments raised by the Environment Agency in their correspondence dated 28th June 2021. This updated assessment of flood risk has reviewed the updates to the data available and

provided conclusions in relation to the original findings of the Hornsea Project Four Onshore Infrastructure FRA (**A6.2.2 Onshore Infrastructure Flood Risk Assessment (APP-098)**).

2.1.9 Further to the above, the findings of this review were subsequently discussed and agreed in a meeting with the Environment Agency on the 7th September 2021 (full minutes of this meeting are presented in **B1.1.1: Consultation Report Evidence Plan (APP-130)** (ON-HYD-7.9). During this meeting, the Applicant discussed the updated National Planning Policy Framework (NPPF) and the potential impact on Hornsea Project Four, specifically in relation to climate change allowances. The outcomes of this review is presented in **Section 6** of this document, as agreed with the Environment Agency during the meeting on 7th September 2021.

3. Hornsea Project Four OnSS information

3.1.1 To inform the Hornsea Project Four FRA, the current proposed design parameters have been obtained from the Applicant's technical team and are summarised as follows:

- The design ground levels for the OnSS are likely to be set at approximately 13 m AOD (the final and exact level will be determined during the detailed design stage pre-construction);
- The design ground levels for the Energy Battery infrastructure (EBI) plants are likely to be set at approximately 14.5 m AOD (the final and exact level will be determined during the detailed design stage pre-construction);
- There will be some levelling of the OnSS to achieve these ground levels; however, the final design (based on topography measurements) will ensure that cutting and filling volumes will be aligned to avoid soil transport off-site; and
- The level for the attenuation feature in the south-east corner is to be confirmed. However, the design principle is to maintain or reduce the current ground levels in this location. The final level will be determined during the detailed design.

3.1.2 A review of the existing 1 m LiDAR data for the Hornsea Project Four OnSS site found that existing ground levels rise from approximately 9.7 m AOD in the south-east corner to approximately 14.5 m AOD to the west. Ground levels rise relatively steeply away from the lowest point in the south-east corner.

3.1.3 March 2022 update – it is acknowledged that confirmation of existing and proposed ground levels has been submitted into the examination since the above information was drafted (**AS-024** and the Applicant's response to ExA written question LV.1.9 in **G2.2**)

4. National Grid Creyke Beck 400 kV Onshore Substation

4.1 Creyke Beck Onshore Substation site

4.1.1 Information in relation to maximum flood water levels and flood depths has been obtained from the National Grid Asset Flood Resilience DRAFT Flood Risk Assessment (hereafter referred to as the National Grid FRA) (Mott MacDonald, 2016).

4.1.2 The flood level information set out in the above report was derived from a site specific Creyke Beck model produced by Mott MacDonald (not made available to Hornsea Project Four). This data was used as the basis of the National Grid FRA to understand the flood risk to the Creyke Beck site.

4.1.3 It is noted within the National Grid FRA that the allowance for freeboard for the Creyke Beck site has been taken as follows:

"National Grid's target level of protection for substations is for the 1 in 1,000-year flood event plus climate change plus 300 mm freeboard. Where this is not achievable, National Grid's minimum level of protection is the 1 in 200-year flood event plus climate change plus 300 mm freeboard".

4.1.4 An initial review of ground levels at the Creyke Beck site has been carried out to understand the topographical differences between the two sites. An extract of the National Grid FRA **Table 1** (reproduced below) shows that ground levels on the Creyke Beck site are lower than those on the Hornsea Project Four OnSS site, where ground levels vary between approximately 9.7 m AOD in the south-east corner and approximately 14.5 m AOD to the west.

Table 1: Site Summary.

Site	Total Site Ownership Area (Freehold) (Hectares)	Total Site Operational Area (Hectares)	Lowest Ground Level (mAOD) within operational boundary	Highest Ground Level (mAOD) within operational boundary
Creyke Beck NG 400kV Compound	10	6.8	8.68	9.46
Northern Powergrid 132kV Compound	N/A	2.1	8.10	8.38

Source: Individual substation areas have been measured from GIS based on outlines; these have not been confirmed by National Grid. Information sourced from 275/400kV Substation Environmental Works Site & Drainage Layout, April 2001 – Drawing no. 12/7638. Refer to Appendix B for more details.

4.1.5 The maximum modelled water levels have been provided within the report for the Creyke Beck site. Flood risk as a combination of fluvial flooding from ordinary watercourses and Wanless Beck is presented within the National Grid FRA **Table 2** (reproduced below).

Table 2: Creyke Beck – Peak Flood Water Level.

Site Compound	Minimum Ground Level (mAOD)	Peak Flood Level (mAOD) for corresponding Flood Event (Annual Exceedance Probability)		
		1 in 100yr (1 0% AEP) +CC (2069)	1 in 200yr (0.50% AEP) +CC (2069)	1 in 1000yr (0.10% AEP) +CC (2069)
Creyke Beck 400kV Compound	8.68	9.40	9.41	9.43
Northern Powergrid 132kV compound	8.10	No Flooding	8.24	8.28

Source: Mott MacDonald 2016. Please note that the flood levels listed above have taken into consideration the "system difference" of 200mm in order to be relevant to the site topographic levels.

4.1.6 The above maximum modelled water levels are specific to the Creyke Beck site and therefore not necessarily applicable to the Hornsea Project Four OnSS. However, they can be used to indicate that based on existing ground levels at the Hornsea Project Four OnSS the maximum modelled water levels are unlikely to affect the Hornsea Project Four OnSS, up to and including the 1 in 1,000 year plus climate change event.

4.1.7 Further information related to the modelling for the Creyke Beck site is set out in 'Appendix D: Modelling Summary and Results' of the report entitled National Grid FRA.

4.1.8 The modelling results presented in Appendix D of the National Grid FRA includes modelled water level and water depth information across a wider area including the Hornsea Project Four OnSS site. The key information has been extracted and considered to assess the potential flood risk to the proposed Hornsea Project Four OnSS.

4.1.9 Results have been presented for the pre-scheme / baseline scenario (i.e. prior to construction works at Creyke Beck) as well as post-scheme scenario. Key results, from Appendix D of the National Grid FRA, are summarised in the following sub-sections alongside key figures from the report showing modelled flood extents and water levels.

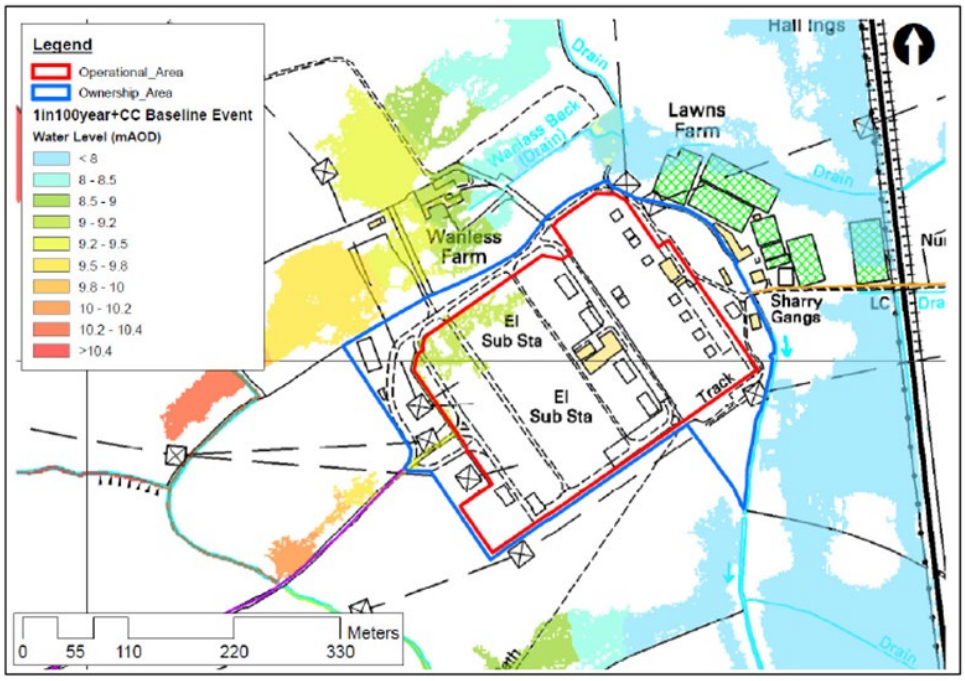
4.2 Pre-scheme results relevant to Hornsea Project Four OnSS

4.2.1 The pre-scheme 1 in 100 year plus climate change results (**Figure 1**) indicate that the modelled maximum water level in the south-east corner of the Hornsea Project Four OnSS site is between 10.2 m AOD and 10.4 m AOD.

4.2.2 The pre-scheme 1 in 200 year plus climate change (**Figure 2**) and 1 in 1,000 year plus climate change (**Figure 3**) modelled water levels are both indicated as being > 10.4 m AOD.

4.2.3 A conservative approach has been taken for the 1 in 100 year plus climate change modelled results and therefore it has been assumed that the maximum modelled flood water level is 10.4 m AOD in the south-east corner of the Hornsea Project Four OnSS site.

4.2.4 For the 1 in 200 year plus climate change and 1 in 1,000 year plus climate change events a comparison has been carried out between the modelled flood extents, modelled water levels and 1 m LiDAR data. For both events, areas with a ground level in excess of 10.5 m AOD do not fall within the modelled flood extent.



Source: Mott MacDonald 2016. Contains Ordnance Survey data © Crown Copyright Ordnance Survey - National Grid EL 100024241.

Figure 1: Baseline 1 in 100 year +CC Peak Modelled Flood Levels.

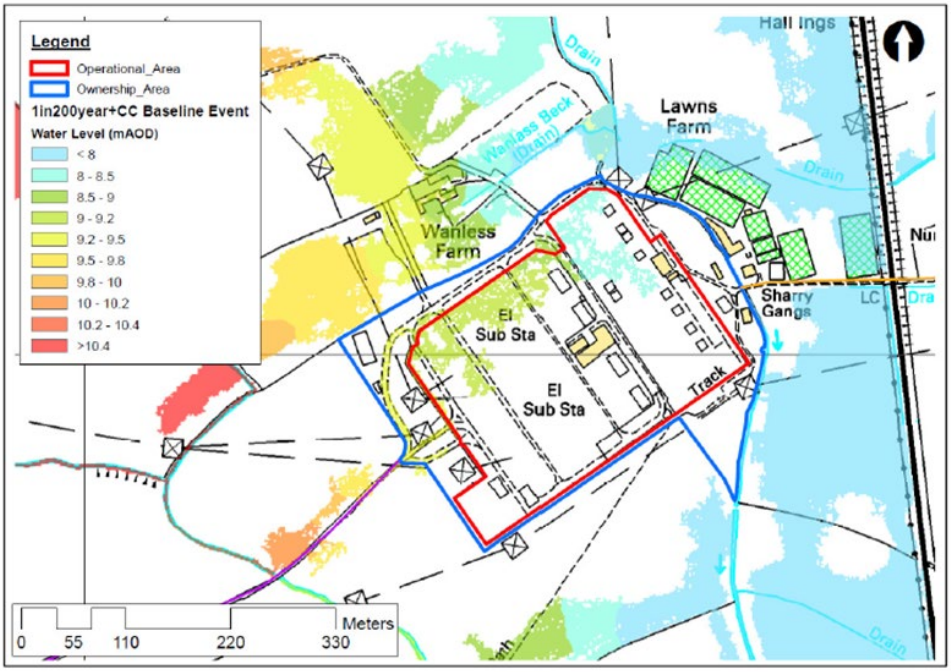


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Figure 2: Baseline 1 in 200 year +CC Peak Modelled Flood Levels.

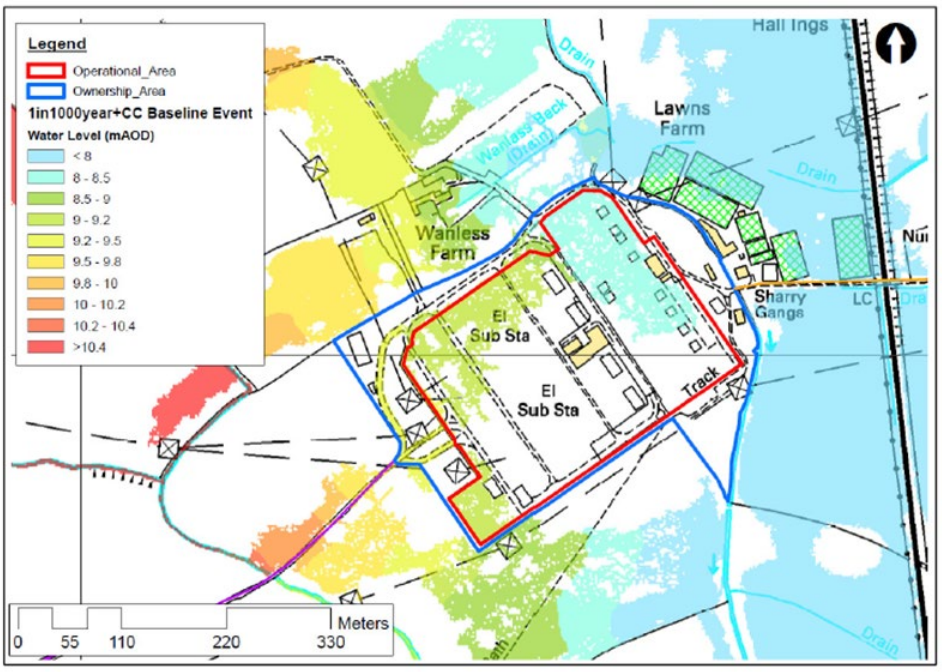

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Figure 3: Baseline 1 in 1000 year +CC Peak Modelled Flood Levels.

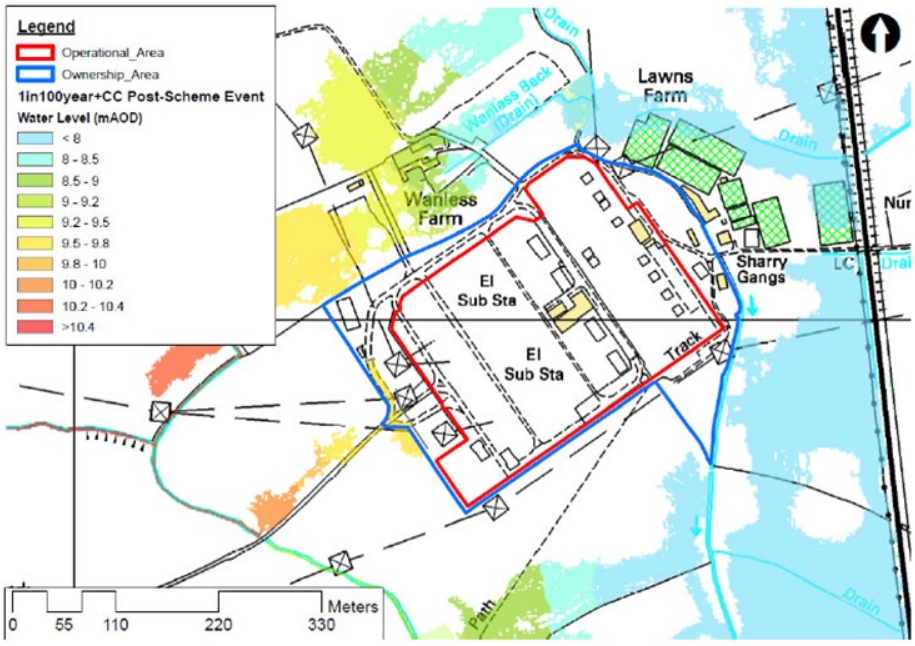
4.3 Post-scheme results relevant to Hornsea Project Four OnSS

4.3.1 The post-scheme 1 in 100 year plus climate change (Figure 4) results also indicate that the modelled maximum water level in the South East corner of the Hornsea Project Four OnSS site is between 10.2 m AOD and 10.4 m AOD.

4.3.2 The post-scheme 1 in 200 year plus climate change (Figure 5) and 1 in 1,000 year plus climate change (Figure 6) modelled water levels are both indicated as being > 10.4 m AOD.

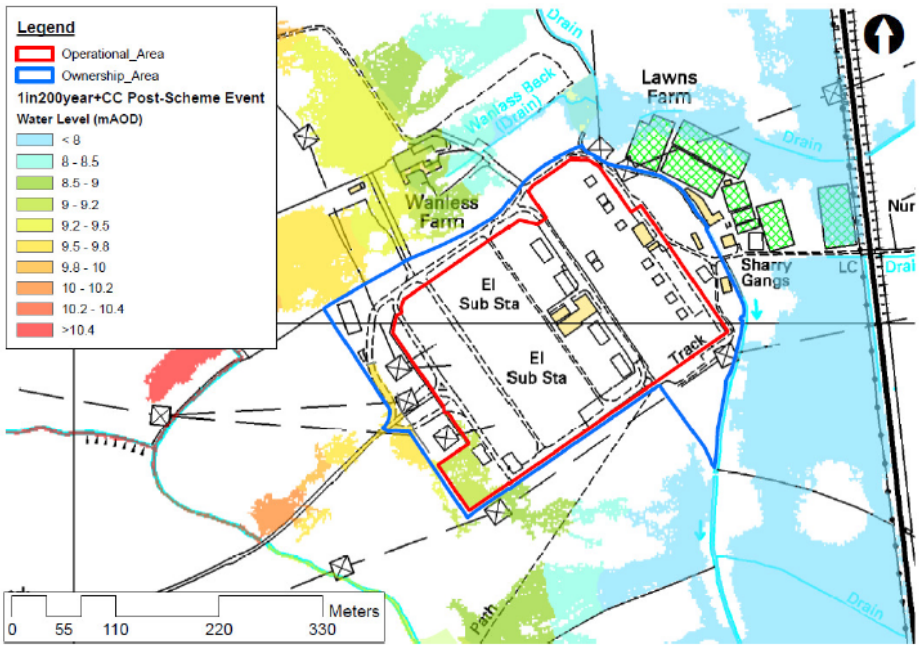
4.3.3 A conservative approach has been taken for the 1 in 100 year plus climate change modelled results and therefore it has been assumed that the maximum modelled flood water level is 10.4 m AOD in the South East corner of the Hornsea Project Four OnSS site.

4.3.4 For the 1 in 200 year plus climate change and 1 in 1,000 year plus climate change events a comparison has been carried out between the modelled flood extents, modelled water levels and 1 m LiDAR data. For both events areas with a ground level in excess of 10.5 m AOD do not fall within the modelled flood extent.



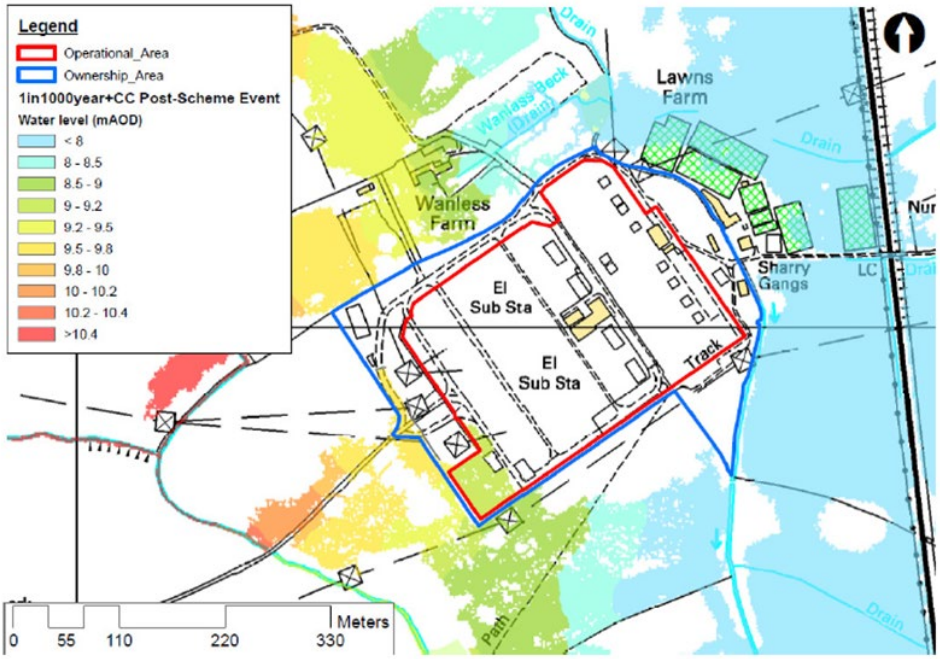
Source: Mott MacDonald 2016. Contains Ordnance Survey data © Crown Copyright Ordnance Survey - National Grid EL 100024241.

Figure 4: Post Scheme 1 in 100 year +CC Peak Modelled Flood Levels.



Source: Mott MacDonald 2016. Contains Ordnance Survey data © Crown Copyright Ordnance Survey - National Grid EL 100024241.

Figure 5: Post-Scheme 1 in 200 year +CC Peak Modelled Flood Levels.



Source: Mott MacDonald 2016. Contains Ordnance Survey data © Crown Copyright Ordnance Survey - National Grid EL 100024241.

Figure 6: Post-Scheme 1 in 1000 year+CC Peak Modelled Flood Levels.

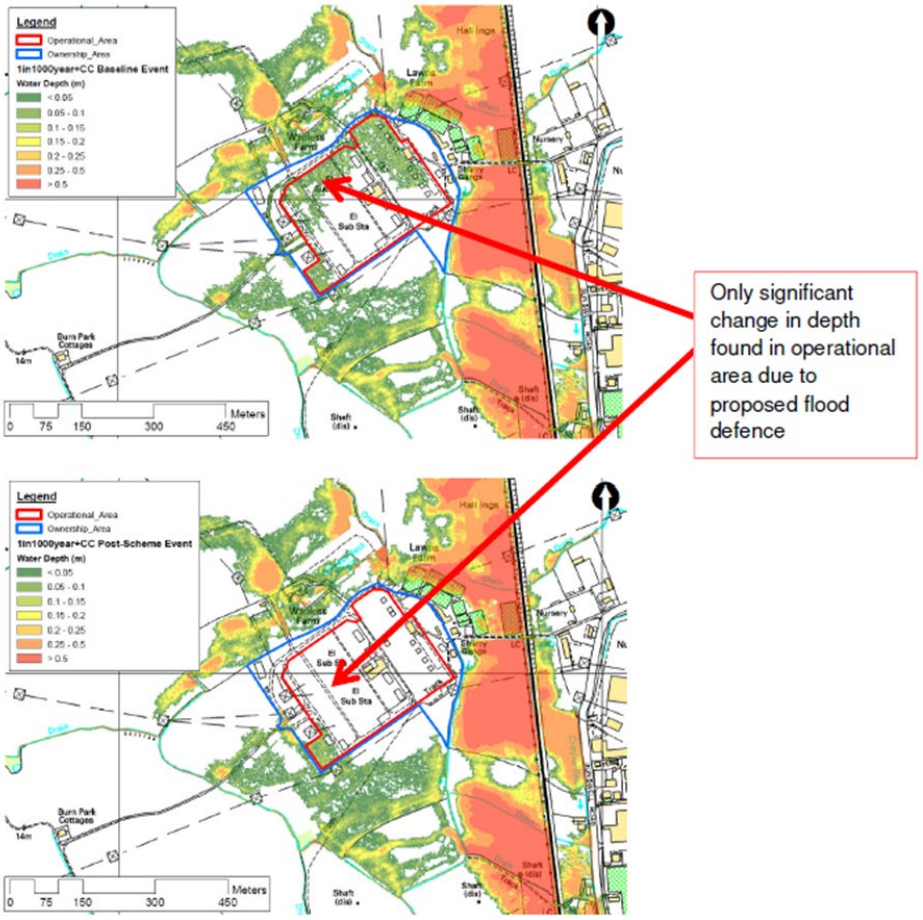
4.3.5 Therefore, in summary the modelled water level information indicates that the Hornsea Project Four OnSS site would experience flooding up to 10.4 m AOD during the 1 in 100 year plus climate change event, both pre- and post-scheme.

4.3.6 In addition, the modelled water level information indicates that the Hornsea Project Four OnSS site would experience flooding up to 10.5 m AOD during the 1 in 200 year plus climate change and 1 in 1,000 year plus climate change event, both pre- and post-scheme.

4.4 Pre- and post-scheme water depth comparison relevant to Hornsea Project Four OnSS

4.4.1 In addition to the presentation of modelled water levels for the pre-scheme and post-scheme scenario, Appendix D of the National Grid FRA also carried out a comparison of the flood depths during the 1 in 1,000 year plus climate change scenario. The modelled extents for this comparison have been reproduced below for reference.

4.4.2 With reference to the south-east corner of the Hornsea Project Four OnSS site it indicates that the maximum flood water depth is within the 0.25 - 0.5 m depth category. Comparing these depths with the LiDAR data and preceding conclusions it confirms that the maximum flood water level is approximately 10.5 m AOD.



Source: Mott MacDonald 2016. Contains Ordnance Survey data © Crown Copyright Ordnance Survey - National Grid EL 100024241.

Figure 7: Comparison between Pre- and Post-Scheme 1 in 1000 year +CC Peak Modelled Flood Depth.

5. Summary on OnSS freeboard mitigation

5.1.1 Following a review of the site-specific hydraulic modelling carried out for the National Grid Creyke Beck 400 kV substation it has been identified that the results of the modelling extend to include the area of the Hornsea Project Four OnSS.

5.1.2 Modelled water level data obtained from the modelling exercise shows that the Hornsea Project Four OnSS site would experience:

- Flooding up to 10.4 m AOD during the 1 in 100 year plus climate change event, both pre- and post-scheme;
- Flooding up to 10.5 m AOD during the 1 in 200 year plus climate change, both pre- and post-scheme; and
- Flooding up to 10.5 m AOD during the 1 in 1,000 year plus climate change event, both pre- and post-scheme.

5.1.3 The proposed Hornsea Project Four OnSS infrastructure is to be set at the following design levels:

- Hornsea Project Four OnSS design levels are anticipated to be approximately 13 m AOD (the final and exact level will be determined during the detailed design stage pre-construction) – This is 2.5 m above the maximum modelled flood extent for the 1 in 1,000 year plus climate change event and therefore inherently includes a significant natural freeboard; and
- The Energy Battery infrastructure (EBI) plants based on the current indicative Hornsea -Project Four OnSS layout, are anticipated to be at approximately 14.5 m AOD (the final and exact level will be determined during the detailed design stage pre-construction) – This is 4 m above the maximum modelled flood extent for the 1 in 1,000 year plus climate change event and therefore inherently includes a significant natural freeboard.

5.1.4 Therefore, the Hornsea Project Four OnSS is not considered to be at risk of flooding from this source during an extreme event.

5.1.5 Levelling works are likely to focus on the existing elevated areas of the site, therefore there will be no raising of ground currently located within the modelled flood extent.

5.1.6 Regarding the attenuation feature proposed for the south-east corner of the Hornsea Project Four OnSS, ground levels will be maintained at the existing level or alternatively lowered. This will be subject to the development of the detailed drainage design. However, there will be no displacement of flood water as a result of ground raising in this location.

5.1.7 Should there be a need to utilise this area to attenuate and store water from the Hornsea Project Four OnSS, it will be sized appropriately to ensure it will store the existing volume of flood water during an event as well as any water arising from the proposed development.

6. Updates to Commitments

6.1.1 Since the last Hornsea Four Environment Agency Evidence Plan meeting which took place on 5th February 2020, some commitments which were presented and agreed with the Environment Agency have since been updated. These are presented below in **Table 3**, with the red text showing changes to the text since the submission of the Preliminary Environmental Information Report (PEIR). Hornsea Project Four is seeking confirmation of agreement on the Commitments below in light of the rationale provided.

Table 3: Relevant updated Hornsea Four Commitments showing changes in red text since PEIR.

Commitment Number (Co)	Commitment as presented on the technical panel meeting on 5th February 2020.	Proposed updated Commitment	Rationale
Co18	HDD entry and exit points will be located at least 9 m away from IDB and Ordinary surface watercourses and 20m from EA surface water courses ~~and~~ or the landward toe of the EA surface watercourse's flood defences. ~~and Where flood defences are present t~~ Where a surface watercourse is to be crossed by HDD, the onshore export cable~~s~~ will be installed at least 1.2 m beneath the hard bed of any ~~the~~ watercourse~~s~~ and the optimal clearance depth beneath watercourses will be agreed with the relevant authorities prior to construction. Where EA flood defences are present a minimum 1.2m vertical clearance will be maintained between the hard bed of the watercourse and the landward toe of those flood defences. Where Hornsea Four crosses sites of particular sensitivity (e.g. embanked EA watercourses, SSSIs or groundwater Inner Source Protection Zones (SPZs)) a hydrogeological risk assessment will be undertaken to inform a site specific crossing method statement which will also be agreed with the relevant authorities prior to construction.	HDD entry and exit points will be located at least 9 m away from IDB and Ordinary surface watercourses and 20m from EA surface water courses or the landward toe of the EA surface watercourse's flood defences. Where a surface watercourse is to be crossed by HDD, the onshore export cables will be installed at least 1.2 m beneath the hard bed of any watercourse and the optimal clearance depth beneath watercourses will be agreed with the relevant authorities prior to construction. Where EA flood defences are present a minimum 1.2m vertical clearance will be maintained between the hard bed of the watercourse and the landward toe of those flood defences. Where Hornsea Four crosses sites of particular sensitivity (e.g. embanked EA watercourses, SSSIs or groundwater Inner Source Protection Zones (SPZs)) a hydrogeological risk assessment will be undertaken to inform a site specific crossing method statement which will also be agreed with the relevant authorities prior to construction.	The term 'embanked EA watercourses' has been included as agreed with the Environment Agency at the technical panel meeting held on 5th February 2020. This is to provide further assurance to the Environment Agency that a hydrogeological risk assessment would be undertaken, and that a site-specific crossing method statement would be agreed with them, specifically where the Environment Agency have concerns about existing embankments e.g at Watton Beck.

Commitment Number (Co)	Commitment as presented on the technical panel meeting on 5th February 2020.	Proposed updated Commitment	Rationale
Co64	Topsoil and subsoil will be stored in separate stockpiles in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298 or the latest relevant available guidance. Any suspected or confirmed contaminated soils will be appropriately separated, contained and tested before removal (if required). Where possible, stockpiling within the floodplain (identified as areas of Flood Zone 2 or 3 as identified on the Environment Agency Flood Map for Planning) of any EA Main River will be avoided.	Co64 Topsoil and subsoil will be stored in separate stockpiles in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298 or the latest relevant available guidance. Any suspected or confirmed contaminated soils will be appropriately separated, contained and tested before removal (if required). Co197 (new): Where reasonably practicable, topsoil & subsoil stockpiling within the floodplain (defined as areas of Flood Zone 2 or 3 as identified on the Environment Agency Flood Map for Planning) of any EA Main River will be avoided at the Onshore Substation.	After further review of the flood zone mapping in relation to the onshore route, Hornsea Project Four is able to commit to the suggested text at the onshore substation. This is reflected in the new Co197. However, due to the large areas of Flood Zone 2 and 3 Hornsea Project Four is unable to make this commitment along the landfall and onshore export cable corridor (see updated Co64 text). Instead, in response to comments raised by the Environment Agency at the technical panel meetings held on 8th April 2019 and 5th November 2019 around pollution prevention and the maintenance of flood plain capacity, Hornsea Four will provide details on the following with the Outline Code of Construction Practice: • Seeding of storage mounds; • Use of silt traps in specific locations; and • Providing periodic gaps in storage mounds to allow water to flow across the floodplain.
Co127	An Onshore Decommissioning Plan will be developed prior to decommissioning. The Onshore Decommissioning Plan will include provisions for the removal of all	An Onshore Decommissioning Plan will be developed prior to decommissioning in a timely manner. The Onshore Decommissioning Plan will include	Inclusion of 'in a timely manner' as proposed by the EA at the last technical panel meeting held on 5th November 2020.

Commitment Number (Co)	Commitment as presented on the technical panel meeting on 5th February 2020.	Proposed updated Commitment	Rationale
	onshore above ground infrastructure and the decommissioning of below ground infrastructure and details relevant to flood risk, pollution prevention and avoidance of ground disturbance. The Onshore Decommissioning Plan will be in line with the latest relevant available guidance.	provisions for the removal of all onshore above ground infrastructure and the decommissioning of below ground infrastructure and details relevant to flood risk, pollution prevention and avoidance of ground disturbance. The Onshore Decommissioning Plan will be in line with the latest relevant available guidance.	
Co172	The bed and banks of watercourses will be reinstated to their pre-construction condition following the removal of any temporary structures. There will be no loss of cross-sectional area to Environment Agency (EA) Main rivers.	The bed and banks of watercourses will be reinstated to their pre-construction condition following the removal of any temporary structures. Culverts will not be used for temporary access track crossings across EA Main Rivers. Where a temporary access track crossing across an EA Main River may be required, clear span/ bailey bridges will be used. There will be no loss of cross-sectional area to Environment Agency (EA) Main rivers.	Hornsea Project Four received the following Section 42 comment from the Environment Agency in 2019: *'Whilst the commitment to follow CIRIA's best practise for culvert installation will help to reduce the adverse impacts of culvert installation, we maintain that it would be more beneficial to use clear span bridge crossings to temporarily cross watercourses. As such, we propose that, for all proposed temporary crossings of main rivers, a commitment to use clear span bridges should be added to the Commitment Register and included within Requirement 16 of the DCO.'* In response Co172 has now been updated to provide security that culverts will not be used for temporary access track crossings of Environment Agency Main Rivers. This is secured through DCO Requirement 16

7. Review of flood risk following Environment Agency correspondence

7.1.1 Following receipt of the correspondence received from the Environment Agency, dated 28th June 2021 (Ref: RA/2021/143235/01-L01), regarding data validity and the Hornsea Project Four, a review of the implications in terms of flood risk has been undertaken.

7.1.2 This review has focused on the following key elements:

- Relevance of the updated Environment Agency's Flood Map for Planning;
- Updated peak river flow allowances in July 2021 and implications for the Hornsea Four Project; and
- Availability of the updated East Riding of Yorkshire Council Level 1 Strategic Flood Risk Assessment.

7.1.3 Although the Environment Agency Flood Map for Planning has been updated in some locations, the current flood extents in the vicinity of the proposed Hornsea Project Four OnSS remain unchanged from those presented in the Hornsea Project Four Onshore Infrastructure FRA (**A6.2.2 Onshore Infrastructure Flood Risk Assessment (APP-098)**).

7.1.4 The Flood Map for Planning continues to show an area at risk of flooding along the southern boundary and in the southern corner of the proposed OnSS site; however, this is in line with the existing, known, flood extent previously discussed with the Environment Agency. The proposed OnSS infrastructure does not encroach into this area, other than the proposed attenuation feature and landscaping, which will be sized appropriately, as part of the detailed drainage design, to accommodate both the surface water flood risk in this location as well as any drainage from the OnSS infrastructure itself. This remains in accordance with the conclusions presented in **Section 4** of this Position Paper.

7.1.5 In addition, the review of the modelling available for the OnSS site has confirmed that the Creyke Beck modelling undertaken to inform the National Grid FRA (Mott MacDonald, 2016), as discussed in **Section 3.1** of this Position Paper, remains the most appropriate modelling for this location. A review of the climate change allowance applied within the Creyke Beck modelling, presented in the National Grid FRA (Mott MacDonald, 2016), confirmed that this modelling utilised a 20% increase in peak river flow allowance. This is in accordance with the information previously presented in the Hornsea Project Four Onshore Infrastructure FRA (**A6.2.2 Onshore Infrastructure Flood Risk Assessment (APP-098)**).

7.1.6 Notwithstanding the above, a review of the revised climate change allowances published by the Environment Agency in their guidance entitled 'Flood risk assessments: climate change allowances' (July 2021), has been undertaken to understand the potential implications for Hornsea Project Four. A subsequent update to this guidance was also published in October 2021. However, this comprised a minor update in the guidance to confirm that for some sites there is a need to understand the implications of the increase in peak river flow allowances for

a neighbouring management catchment. This is not considered to be of specific relevance to the Hornsea Four OnSS due to its position away from the boundary of the management catchment and therefore has not been considered further in this review.

7.1.7 With regard to the amended Environment Agency guidance on peak river flow allowances published in July 2021, it has been identified that the Hornsea Four OnSS is located in the Hull and East Riding management catchment. Assuming a 35-year development lifetime, the increase in peak river flow allowances for this management catchment have been summarised as follows:

- 2050s Central Allowance – 9%;
- 2050s Higher Central Allowance – 17%; and
- 2050s Upper End Allowance – 37%.

7.1.8 The Environment Agency guidance (July 2021) sets out the criteria to be adopted for different types of development. As the OnSS infrastructure is elevated above the surrounding area and located in Flood Zone 1, the guidance indicated that the appropriate peak river flow allowance to be used, when considering the OnSS infrastructure, would be the Higher Central allowance of 17%.

7.1.9 Furthermore, the Environment Agency guidance (July 2021) indicates that for Nationally Significant Infrastructure Projects (NSIPs) the upper end allowance should be assessed for peak river flow allowances, although the guidance also notes that this should be considered as a sensitivity test.

7.1.10 This guidance was discussed during the meeting with the Environment Agency held on the 7th September 2021 (full minutes of this meeting are presented in **B1.1.1: Consultation Report Evidence Plan (APP-130)** (ON-HYD-7.9). It was agreed that the allowance set out in the updated Environment Agency guidance (July 2021) is lower than that used in the Creyke Beck modelling (Mott MacDonald, 2016) and therefore a conservative assessment to the consideration of peak river flow allowances has already been adopted in the Hornsea Project Four Onshore Infrastructure FRA (**A6.2.2 Onshore Infrastructure Flood Risk Assessment (APP-098)**).

7.1.11 Additionally, when considering the sensitivity test allowance of 37%, it was acknowledged during the meeting that, as set out in **Section 4** of this Position Paper, the OnSS infrastructure is located on ground sufficiently elevated that it is unlikely to be affected by the flood extent associated with the 37% increase, taking into account the relatively flat topography of the wider area and the freeboard (i.e. greater than 2.5m) associated with the OnSS infrastructure above the maximum water level for the 1 in 1,000 year plus climate change event.

7.1.12 On the basis of the above, it is concluded that the updated peak river flow allowances in the Environment Agency (July 2021) guidance do not alter the conclusions in relation to fluvial flood risk to the OnSS infrastructure from those presented in the Hornsea Project Four Onshore Infrastructure FRA (**A6.2.2 Onshore Infrastructure Flood Risk Assessment (APP-098)**).

7.1.13 Additionally, a review of the updated East Riding of Yorkshire Council Level 1 Strategic Flood Risk Assessment (SFRA) (November 2019) has been undertaken to understand whether any of the information contained therein would alter the conclusions presented in the Hornsea Project Four Onshore Infrastructure FRA (**A6.2.2 Onshore Infrastructure Flood Risk Assessment (APP-098)**). Following a review of the SFRA and associated mapping, it was noted that new information of relevance to the OnSS infrastructure relates to the mapping layer entitled 'Indicative climate change extents of areas not covered by detailed modelling'. This mapping layer provides an indication of those locations that may be subject to flooding in the future.

7.1.14 A review of this mapping layer noted that the flood extent in this location, relevant to the Hornsea Project Four OnSS infrastructure, is similar to the present-day Flood Zone 2. This flood extent is shown to affect the southern boundary and south-eastern corner of the Hornsea Four OnSS, similar to the flood extent noted in **paragraph 6.1.4** above. On this basis, despite updates to the information being available, it can be concluded that there is no change to the understanding of present and future flood risk in this location.

7.1.15 On the basis, of the above review it has been concluded that the updated guidance and information does not alter the understanding of flood risk to the OnSS infrastructure, both now and in the future.

7.1.16 As such, the conclusions of the Hornsea Project Four Onshore Infrastructure FRA (**A6.2.2 Onshore Infrastructure Flood Risk Assessment (APP-098)**) remain valid, with limited flood risk to the OnSS infrastructure during its lifetime and no increase in off-site flood risk as a result of the proposed development.

8. References

East Riding of Yorkshire Council Level 1 Strategic Flood Risk Assessment (Available online at https://www.eastriding.gov.uk/planning-permission-and-building-control/planning-policy-and-the-local-plan/strategic-flood-risk-assessment/) (November 2019).

Environment Agency Flood risk assessments: climate change allowances (Available online at https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances) (July 2021).

National Grid Asset Flood Resilience DRAFT Flood Risk Assessment, Creyke Beck 400 kV Substation National Grid, Ref: PDD-30744-2-REP-121, Mott MacDonald (April 2016).