



# Triton Knoll Offshore Wind Farm Limited Triton Knoll Electrical System

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## **Appendix A: Environmental Statement Addendum Relating to Works at Bicker Fen**

**Date: November 2015**

**Appendix A of the Bicker Fen  
Extension and Reconfiguration  
Note**

Triton Knoll Offshore Wind Farm Limited

## Triton Knoll Electrical System

Environmental Statement Addendum Relating  
to Works at Bicker Fen

Appendix A of the Bicker Fen Extension and  
Reconfiguration Note

Date: November 2015

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## 1. INTRODUCTION

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### Reason for this Addendum

- 1.1 This Addendum has been prepared in respect of Triton Knoll Offshore Wind Farm Limited's (TKOWFL or the Applicant) application for a development consent order (DCO) under the Planning Act 2008 (the Application).
- 1.2 Further to the submission of the Application in May 2015, National Grid has advised the Applicant that its proposals for works at the existing Bicker Fen Substation (referred to within the ES as Enabling Works) have been amended. The works will now comprise the NGET Substation Extension Works (linked to wider upgrade and reconfiguration of the Bicker Fen substation) and the NGET Enabling Works (linked to the connection of Triton Knoll). These amendments have implications on the information presented within the ES.
- 1.3 In light of proposed amendments to the National Grid works at Bicker Fen Substation, a detailed review of the onshore chapters of the ES has been undertaken to determine whether the amended National Grid works and associated amendments to the TKES Unlicensed Works materially change the declared conclusions of the EIA. This task has comprised an initial scoping review of the ES followed by a more detailed review of assessments where required.
- 1.4 This document has been prepared to present the details of the amended National Grid works at Bicker Fen substation (comprising the Enabling Works and Substation Extension Works). It also details changes to the associated Unlicensed Works (required as a consequence of the Enabling Works and Substation Extension Works) and reports the findings of the ES review process against these amendments.
- 1.5 The structure of this document is as follows:
  - Section 1: Introduction
  - Section 2: Approach to TKES Unlicensed Works, NGET Enabling Works and NGET Substation Extension Works
  - Section 3: Scoping Review of Assessment of Unlicensed Works
  - Section 4: Scoping Review of Assessment of Cumulative Impacts
  - Section 5: Review of Landscape & Visual Assessment
  - Section 6: Review of Traffic & Transport Assessment
  - Section 7: Review of Hydrology & Flood Risk Assessment
  - Section 8: Appendices

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## 2. APPROACH TO UNLICENCED WORKS, ENABLING WORKS AND SUBSTATION EXTENSION WORKS

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### Introduction

- 2.1 The Unlicensed Works form part of the Triton Knoll Electrical System (TKES) project and were therefore assessed in the EIA as part of the TKES project. The National Grid Enabling Works do not form part of the Triton Knoll project. However, they were assessed as part of the cumulative assessment. In addition to the National Grid Enabling Works, National Grid Electrical Transmission (NGET) has now advised that it also plans to undertake Substation Extension Works at the existing Bicker Fen Substation. The Substation Extension Works were not assessed as part of the cumulative assessment as TKOWFL was not aware of them prior to the submission of the TKES DCO application in April 2015.
- 2.2 The three components relevant to the extended and reconfigured works at Bicker Fen substation are set out below:
- **TKES Unlicensed Works:** The electrical works needed to connect the TKOWF to Bicker Fen that NGET is not required, pursuant to its transmission licence, to carry out itself. The Unlicensed Works will consist of erection and installation of relevant equipment: two connection bays to facilitate connection of the 400 kilovolt (kV) cables to the NGET infrastructure and include but are not limited to equipment such as cable sealing ends, circuit breakers, surge arrestors, dis-connectors, current and voltage transformers, busbars and busbar clamps, power quality measurement equipment, a relay/marshalling room and an electrical earthing system. The Unlicensed Works form part of the TKES and are therefore the responsibility of TKOWFL.
  - **NGET Substation Extension Works:** The new works that would be needed to extend the footprint of the existing Bicker Fen Substation at the north eastern boundary to accommodate additional transmission system reinforcements to the existing network in order to accommodate further third party connections. NGET is responsible for the Substation Extension Works and this does not form part of the TKES.
  - **NGET Enabling Works:** The works that NGET will need to undertake within its Bicker Fen Substation (either within the footprint of the existing compound or within the potential new extension) in order to connect the TKOWF to the national grid. The Enabling Works include the creation of two new connection skeleton bays within the NGET Bicker Fen substation, including the installation of new switchgear

and busbars and associated earthworks. NGET is responsible for the Enabling Works and this does not form part of the TKES.

## Details of Unlicensed Works adopted for the ES

2.3 The details of the TKES Unlicensed Works were detailed in Table 1-2 of Volume 3, Chapter 1, *Onshore Project Description* of the ES. The Unlicensed Works were assumed to include:

- Site mobilisation, fencing, welfare and plant delivery;
- Earthworks;
- Installation of electrical infrastructure; and
- Reinstatement, demobilisation and landscaping.

2.4 The following assumptions were made for the purposes of the EIA:

- The TKES Unlicensed Works will take place entirely within the existing footprint of the substation, within the areas identified in Appendix B, Annex 1 Figure 1-5 (REV01) as the 'Maximum footprint of unlicensed bays required for the TKES within the existing NGET Bicker Fen compound'.
- Both bays may be located on the north eastern end of the substation, or alternatively one bay may be at the north eastern end and one at the south western end. If both bays are located at the northern end cabling will not be required within the green squared area shown on Appendix B, Annex 1 Figure 1-5 (REV01).
- A Temporary Construction Compound (TCC 26) will be required and will have a footprint of approximately 1.2 ha (see Appendix B, Annex 1 Figure 1-5, REV01).

## Amended Unlicensed Works

2.5 As a result of the potential extension to the existing NGET substation (NGET Substation Extension Works) (see details in paragraph 2.13 below), a number of amendments to the Unlicensed Works element of the TKES are required. The amendments are as follows (the items in italics are as previously assumed for the purposes of the ES, i.e. there is no change to these items):

- The TKES Unlicensed Works will take place either within the existing footprint or within the potential extension of the NGET Bicker Fen substation compound, within the areas identified in Appendix B, Annex 1 Figure 1-5 (REV01) as the 'Search area for Triton Knoll unlicensed bays'. The southern area of search is 0.7 ha in area, and the northern area of search is 2 ha in area.

- TCC 26 will be located at a revised location within the Order Limits as identified on Appendix B, Annex 1 Figure 1-5 (REV01). TCC 26 will comprise two areas (0.5 ha and 0.3 ha) totalling approximately 0.8 ha.
- *Both bays may be located on the north eastern end of the substation, or alternatively one bay may be at the north eastern end and one at the south western end. If both bays are located at the northern end cabling will not be required within the green squared area shown on Figure 1-5 (see Appendix B, Annex 1 REV01).*

2.6 There is no change to either the scale/dimensions of the Unlicensed Works or the plant and equipment required for the Unlicensed Works from that assumed in the EIA.

### **Details of Enabling Works adopted for the ES**

2.7 As detailed in Volume 3, Chapter 1, *Onshore Project Description* of the ES, NGET is responsible for undertaking work at the existing Bicker Fen substation to facilitate connection of the Triton Knoll Offshore Wind Farm (TKOWF) array. These works are referred to as the NGET 'Enabling Works'.

2.8 During the EIA for the proposed development the Applicant was involved in numerous discussions with NGET in order to obtain details of the proposed NGET Enabling Works as detailed in Bicker Fen Extension and Reconfiguration Note (Appendix [ ] of the Applicant's Response to Deadline 3). At the time of the submission of the DCO application in April 2015, it was the Applicant's understanding that the NGET Enabling Works could be accommodated within the existing substation compound boundary and would be undertaken under permitted development rights.

2.9 The following assumptions were made for the purposes of the EIA:

- The Enabling Works will be limited to works within the current Bicker Fen substation fence line and on the current hard-standing footprint.
- The Enabling Works include the installation of new switchgear and busbars and associated earthworks.
- The Enabling Works will allow the current single busbar substation to operate as a double busbar site.
- The Enabling Works are anticipated to include additional substation plant and equipment (max 15 m in height) including relay rooms to house plant and machinery (approx 5 m in height).

### **Substation Extension Works**

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- 2.10 Since the TKES application was accepted by the Secretary of State for examination in May 2015, additional transmission system reinforcements have been identified as necessary by NGET, and the design of the Bicker Fen substation has been reviewed to accommodate these additional works. Consequently, NGET has concluded there is likely to be a need to extend and further reinforce the existing Bicker Fen substation in order to accommodate all the potential connections.
- 2.11 To accommodate this additional infrastructure NGET would need to increase the overall substation footprint. The proposed NGET Substation Extension as provided will be to the north eastern boundary of the existing substation location, and is expected to extend the substation operational boundary. Full details of the design changes are provided at Appendix C (Annex 2) - Summary of Design Changes at Bicker Fen Substation
- 2.12 The following assumptions apply to the NGET Substation Extension Works, which were not previously assessed as part of the ES:
- The NGET Substation Extension Works will require an extension to the existing Bicker Fen substation by approximately 110m to the north east.
  - The extension will comprise permeable hard standing (stone chippings) and fencing to an area of 1.2 ha.
- 2.13 Please see Appendix B (Annex 1) Figure 1-5 (REV 01), which shows the extent and location of the potential NGET Substation Extension Works to the Bicker Fen substation.

## Amended Enabling Works

- 2.14 In terms of the amended NGET Enabling Works, the electrical plant and equipment identified by National Grid as necessary will be the same as assessed for the TKES DCO application submitted in April 2015. Further, this is of a similar scale and appearance to the existing infrastructure at the existing Bicker Fen substation. All plant and equipment will be outdoor, air insulated equipment that will be distributed across the existing and extended substation footprint. None of the substation equipment will exceed a maximum height of 12.5m, with the majority of equipment expected to be lower than this height. No additional overhead line works will be required as part of the NGET Enabling Works.
- 2.15 It is expected that the NGET Enabling Works will be undertaken over a 24 month period.
- 2.16 The following assumptions now apply to the NGET Enabling Works (the items in italics are as previously assumed for the purposes of the ES, i.e. there is no change to these items):
- As a result of the NGET Substation Extension Works (see below), the Enabling Works will be located within the existing substation fence line or within an extension to the existing Bicker Fen substation.
  - The NGET Enabling Works will include the installation of new switchgear and busbars and associated earthworks.
  - *The NGET Enabling Works works will allow the current single busbar substation to operate as a double busbar site.*
  - *The NGET Enabling Works are anticipated to include additional substation plant and equipment (max 15 m in height) including relay rooms to house plant and machinery (approx 5 m in height).*

## 3. SCOPING REVIEW OF ASSESSMENT OF UNLICENCED WORKS

- 3.1 In light of amendments to the TKES Unlicensed Works (see paragraph 2.4 above), a detailed review of the onshore chapters of the ES has been undertaken to determine whether the changes materially affect the declared conclusions of the EIA. An initial scoping exercise has been undertaken considering the change to the proposed development relevant to each topic and any resulting change to the outcome of the impact assessments.
- 3.2 The scoping review identified that there is a potential change to the impact assessment for the following topics and these are considered in detail in sections 5 and 7 below:

- Chapter 2: Landscape and Visual (see Section 5)
- Chapter 7: Hydrology and Flood Risk and Flood Risk Assessment (see Section 7)

3.3 The scoping review identified that there is no potential change to the impact assessment for the following topics:

- Chapter 3: Socio-economics, Tourism and Recreation
- Chapter 4: Terrestrial Ecology
- Chapter 5: Land Use, Soils and Agriculture
- Chapter 6: Geology, Hydrogeology and Ground Conditions
- Chapter 8: Historic Environment
- Chapter 9: Traffic and Access
- Chapter 10: Air Quality and Annex 10.2 Air Quality Assessment
- Chapter 11: Noise and Vibration

3.4 Detailed findings of the scoping review of impact assessment due to the amended TKES Unlicensed Works are presented in Table 1 of Annex 1. The scoping table sets out an overview of the potential changes in impacts from those stated in the submitted ES.

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## 4. SCOPING REVIEW OF ASSESSMENT OF CUMULATIVE IMPACTS

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### Cumulative Assessment

- 4.1 As detailed in Volume 1, Annex 3.1 *Approach to Cumulative and Inter-relationships Impact Assessment for the Triton Knoll Electrical System* of the ES, one of the projects considered in the assessments of cumulative impacts for onshore EIA topics was the NGET Enabling Works (referred to as Map Ref No. 68).
- 4.2 The details of the NGET Enabling Works for the purpose of the cumulative assessment were as detailed in paragraph 2.8 above.

### Cumulative Impact Assessment Review

- 4.3 In light of amendments to NGET's proposed works at the Bicker Fen Substation (now comprising NGET Enabling Works and NGET Substation Extension Works; see paragraphs 2.9 - 2.13 above), a detailed review of the onshore chapters of the ES has been undertaken to determine whether the changes materially affect the declared conclusions of the EIA. An initial scoping exercise has been undertaken considering the change to the proposed development and cumulative projects relevant to each topic and any resulting change to the outcome of the cumulative impact assessments.
- 4.4 The cumulative scoping review identified that there is a potential change to the impact assessment for the following topics and these are considered in detail in sections 5, 6 and 7 below:
- Chapter 2: Landscape and Visual (see Section 5)
  - Chapter 7: Hydrology and Flood Risk and Flood Risk Assessment (see Section 7)
  - Chapter 9: Traffic and Access (see Section 6)
- 4.5 The cumulative scoping review identified that there is no potential change to the impact assessment for the following topics:
- Chapter 3: Socio-economics, Tourism and Recreation
  - Chapter 4: Terrestrial Ecology
  - Chapter 5: Land Use, Soils and Agriculture
  - Chapter 6: Geology, Hydrogeology and Ground Conditions
  - Chapter 8: Historic Environment
  - Chapter 10: Air Quality and Annex 10.2 Air Quality Assessment
  - Chapter 11: Noise and Vibration

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- 4.6 Detailed findings of the scoping review of cumulative impact assessment due to the NGET Substation Extension Works, NGET Enabling Works and TKES Unlicensed Works are presented in Table 2 of Annex 1. The cumulative scoping table sets out an overview of the potential changes in impacts from those stated in the submitted ES.

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## 5. REVIEW OF LANDSCAPE & VISUAL ASSESSMENT

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### Introduction

- 5.1 The scoping exercise has identified that the amended TKES Unlicensed Works, amended NGET Enabling Works and new NGET Substation Extension Works may result in changes to the landscape and visual impact assessment and cumulative landscape and visual impact assessment as reported in the ES. The Applicant has therefore revisited the original assessment. No changes to the baseline have been identified and the original baseline assessment, as set out in Volume 5, Annex 2-1, remains valid.

### Review of Assessment

#### Unlicensed Works

- 5.2 Photographic plates, one for each of the seven viewpoints selected to assess the visual effects of the works, were produced as supporting illustrative information to aid the written assessment provided (Volume 5, Annex 2-2). The NGET works at Bicker Fen Substation (comprising the Enabling Works and Substation Extension Works) require a minor amendment to each of the seven viewpoint plates to ensure that the area indicated as 'Proposed Additional Infrastructure for the Unlicensed Works at the Existing NGET Substation - Bicker Fen' correctly reflects the maximum extent of works following the amendment. These plates (Plates 1-3-2, 1-3-3, 1-3-4, 1-3-5, 1-3-6 and 1-3-7) have been amended (as Rev 01) and are included within Appendix A of this report together with the original plates (Rev 00).
- 5.3 Given the change to the extent of the Unlicensed Works, a desk based review has been provided of the original operational landscape and visual assessments, to ensure that the assessments reported in Volume 3, Chapter 2 Landscape and Visual of the ES remain accurate. The detailed review is set out in Table 3 in Annex 1. Following this desk based review, it has been identified that the increase in the dimensions of the Unlicensed Works does not alter any of the findings of the original landscape and visual assessment.
- 5.4 In summary of the findings set out in Table 3 in Annex 1, the construction and operational landscape and visual effects set out in paragraphs 2.336 to 2.392 and 2.680 to 2.735 respectively of the original ES (Volume 5, Chapter 2) remain valid and there is no alteration to the assessment.

### Mitigation

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- 5.5 Following the review of the Construction assessments and the Year 1 and Year 15 operational assessments, due consideration has been given as to whether the mitigation proposed remains sufficient to mitigate the identified Year 1 significant effects. This consideration has concluded that, particularly given no alteration to the original assessment has been identified, no change to the embedded mitigation is deemed to be required.

### **Cumulative Assessment**

- 5.6 Following the production of this revised assessment a review has been carried out of the original cumulative assessment in paragraphs 2.772 to 2.775 of the ES (Volume 5, Chapter 2) following the changes to the NGET Enabling Works.
- 5.7 The original cumulative assessment identified the potential for some cumulative landscape and visual effects with the NGET Enabling Works (Map Ref No. 68), which is located within the TKES Unlicensed Works site and relates to a limited increase in the extent of infrastructure proposed by National Grid. Given that no additional landscape and visual effects have been identified as a result of the NGET Enabling Works and NGET Substation Extension Works, no additional cumulative landscape and visual effects have been identified.

### **Summary of landscape and visual assessment review**

- 5.8 Further to the submission of the Application in May 2015, NGET has advised the Applicant that NGET's proposals for works at the existing Bicker Fen Substation have been amended. These amendments have implications on information presented within the ES, including the LVIA. This primarily relates to a change in location of the temporary construction compound to a position further north within the cable route corridor during construction and, during the operational period, the extension in area coverage of the potential works in the north-eastern part of the existing substation site.
- 5.9 In light of the changes, the applicant has produced revised plates for the viewpoints which were illustrated in Volume 5, Annex 2.2: Photomontages, Part 6, of the ES. The plates refer to Viewpoints 1, 2, 4, 5, 6, 7 and 8. Revised visualisations are at Appendix B (Annex 2).
- 5.10 Following a review of the new images and the original assessment, it has been identified that the changes to the NGET works at Bicker Fen Substation (comprising the Enabling Works and Substation Extension Works) do not alter any of the findings of the original landscape and visual assessment, and no additional mitigation is deemed to be required. In addition to the main assessment, the cumulative assessment has been reviewed and no change to the original cumulative assessment is required.

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## 6. REVIEW OF TRAFFIC & TRANSPORT ASSESSMENT

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### Introduction

- 6.1 The scoping exercise has identified that the NGET works at Bicker Fen Substation (now comprising the Enabling Works and Substation Extension Works) may result in changes to the traffic and transport cumulative impact assessment as reported in the ES.
- 6.2 A review of the cumulative traffic and transport assessment as a result of the NGET Enabling Works and NGET Substation Extension Works has been undertaken and is presented below.

### Review of Assessment

#### Unlicensed Works

- 6.3 As noted in the scoping review in Table 1, there is no material change to the traffic volumes associated with the TKES Unlicensed Works as a result of the amended NGET Enabling Works and NGET Substation Extension Works. The original traffic assessment therefore remains valid.

#### Cumulative Assessment

- 6.4 Updated traffic flows provided by NGET for the Enabling Works and Substation Extension Works have been compared with those considered in the original cumulative assessment to determine the difference in volumes of light goods vehicle (LGV) and heavy good vehicle (HGV) deliveries and the impact of these on the baseline traffic conditions deliveries. The original assessment considered 20 LGVs and 24 HGVs movements per day.
- 6.5 NGET has provided an estimated volume of HGV and LGV deliveries for the duration of the construction period for the NGET Enabling Works and NGET Substation Extension Works as detailed in Table 1 below. These traffic numbers are based on current estimates, with exact phasing of HGV and LGV movements will be subject to confirmation once construction programmes are finalised. The updated traffic flows provided by NGET for the Enabling Works and Substation Extension Works result in a maximum of 60 LGV movements and 32 HGV movements per day.

**Table 1: Estimated distribution of HGV and LGV deliveries for Enabling Works and Substation Extension Works (as provided by National Grid)**

Month	Construction Activity	HGVs for period	Av. LGVs per day	Associated NG Works
1	Site Establishment	27	20/day	Extension
2-3	Ground Preparation	650	30/day	Extension
4-12	Major Civil Works (earthworks)	1634	30/day	Extension
7-15	Civil Works (foundations)	72	15/day	Enabling
9 - 20	Electrical Plant installation	198	20/day	Enabling
20-24	Energisation of circuits	0	10/day	Enabling

6.6 Table 2 below provides a summary of the maximum daily traffic movements used in the original assessment and those currently under consideration based on a worst case of total number of deliveries associated with both the NGET Enabling Works and NGET Substation Extension Works.

**Table 2: Summary of the daily traffic movements – NGET Enabling Works and NGET Substation Extension Works**

	LGVs	HGVs	Total
Original assessment	20	24	44
Current assessment	60	32	92

6.7 The traffic associated with cumulative developments was illustrated in Figure 9-16 (REV01) of the ES to present the total impact of all cumulative projects. These traffic volumes were added to the 2017 baseline scenario upon which the TKES construction traffic impact was assessed. Figure 9-16 (REV01) has been updated to account for the NGET Enabling Works and NGET Substation Extension Works (see Figure 9-16 REV01).

6.8 Given the background flows on the roads assessed for the 2017 baseline scenario, the amended movements will result in very little change to the percentage impact of

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construction traffic. As a result, there is no change to the conclusions of the assessment.

6.9 The detailed finding of the review are set out in Table 4 of Annex 1.

### **Summary of traffic and transport review**

6.10 Further to the submission of the Application in May 2015, National Grid have advised the Applicant that NGET's proposals at the existing Bicker Fen Substation now include Enabling Works and Substation Extension Works. These changes have implications on information presented within the ES, including the cumulative traffic assessment. This primarily relates to a revision in the traffic volumes of LGV and HGV deliveries as a result of the Enabling Works and Substation Extension Works.

6.11 In light of the changes, the Applicant has re-visited the cumulative traffic assessment and prepared a revised Appendix B Annex 3 Figure 9-16 (REV01).

6.12 Following assessment of the revised LGV and HGV volumes associated with the NGET Enabling Works and NGET Substation Extension Works, it has been identified that the changes to the Enabling Works do not alter any of the findings of the original traffic and transport cumulative assessment.

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## 7. REVIEW OF HYDROLOGY & FLOOD RISK ASSESSMENT

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### Introduction

- 7.1 The scoping exercise has identified that the Substation Extension Works and Enabling Works may result in changes to the impact assessment of the Unlicensed Works in Volume 3, Chapter 7 Hydrology and Flood Risk in the ES and the Flood Risk Assessment annex (FRA; document reference 6.2.5.7.3).
- 7.2 The cumulative scoping exercise identified that the Substation Extension Works and Enabling Works, also result in changes to the Hydrology and Flood Risk cumulative impact assessment as reported in the ES.
- 7.3 A review of the changes required to Chapter 7 of the ES and the changes required to the FRA annex are presented separately below.
- 7.4 The three components applicable to both elements of this review are set out in paragraph 2.2 above.

### Review of Assessment

#### Review of the impact and cumulative impact assessment

- 7.5 The Unlicensed Works are relevant to the environmental assessment of impacts during the construction, operation and decommissioning phases of the proposed development.
- 7.6 The Substation Extension Works and Enabling Works are relevant to the cumulative assessment of impacts of the proposed development.
- 7.7 Figures 7-3, 7-14, 7-15 and 7-16 of Chapter 7 of the ES have all been edited to reflect the changes to the NGET Substation (potential extension), the NGET Enabling Works and the TKES Unlicensed Works. Please see Figures 7-3 (REV01), 7-14 (REV01), 7-15 (REV01) and 7-16 (REV01) In Appendix B Annex 4 of the Bicker Fen Extension and Reconfiguration Note. It can be seen that none of the proposed changes fall outside of the Order Limits.

#### Embedded mitigation

- 7.8 Embedded mitigation measures apply to the TKES Unlicensed Works. These measures are the same as in the ES and can be summarised as follows in Table 3.

**Table 3: Embedded mitigation relating to Hydrology and Flood Risk**

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Element	Mitigation measures embedded into the project design
Design	
TKES Unlicensed Works	<p>Piling for foundations will be less than the depth to the underlying chalk aquifer.</p> <p>As per the drainage strategy referenced in Annex 7-3 (which forms the surface water drainage scheme), ensure that runoff from the final development is managed in line with the existing drainage arrangements for the site.</p> <p>Above Ground Electrical Infrastructure will be raised above the (0.1%) 1 in 1000 year plus climate change annual probability flood level.</p>
Construction	
TKES Unlicensed Works	<p>Appropriate industry best practice and published guidelines will be followed to reduce pollutant and sediment movement during all aspects of construction through a construction environmental management plan or similar document. Guidelines include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• Environment Agency, Pollution Prevention Guidance Note 6 (PPG6): Pollution Prevention Guidelines – Working at Construction and Demolition Sites</li> <li>• Environment Agency, Pollution Prevention Guidance Note 5 (PPG5):– Working in, near or liable to affect watercourses;</li> <li>• Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors CIRIA (C650);</li> <li>• CIRIA – SuDS Manual</li> </ul> <p>Construction materials and spoil materials will be positioned in a manner that does not constrain potential flood waters unduly or direct flood waters towards population or industrial centres of high</p>

Element	Mitigation measures embedded into the project design
	<p>sensitivity.</p> <p>Construction will not be undertaken during very extreme wet weather where erosion of sediments and risk from flooding may increase.</p> <p>Existing land drainage will be re-instated to ensure land drainage is unaffected.</p>
Operation	
TKES Unlicensed Works	<p>Maintenance and repairs will follow the same rules, regulations and best practice (or updated recommendations as exist) as were followed during construction including obtaining consent from the relevant consenting bodies where repairs are required adjacent to a watercourse (i.e. within 9 metres).</p>
Decommissioning	
TKES Unlicensed Works	<p>Maintenance and repairs will follow the same rules, regulations and best practice (or updated recommendations as exist) as were followed during construction including complying with the provisions of the bylaws of relevant authorities where repairs are required adjacent to a watercourse (i.e. within 9 metres).</p>

### **Environmental assessment: Construction, operation and decommissioning phases**

- 7.9 The proposed change in location of the TKES Unlicensed Works, from within the existing Bicker Fen Substation to within the Substation Extension Works area, subtly changes the design envelope scenario assessed in the Hydrology and Flood Risk chapter of the ES.
- 7.10 There are five critical aspects of the design envelope scenario of the TKES Unlicensed Works that may influence the impact assessment in terms of Hydrology and Flood Risk. These aspects are:
- Length of construction time;
  - Proximity to watercourses;

- Maximum total impermeable area to be installed;
- Critical equipment flood raising criteria; and
- Size and location of TCC26.

7.11 Table 7-9 of the Hydrology and Flood Risk Assessment of the ES described the design envelope scenario that is used for the impact assessment. This described the TKES Unlicensed Works as follows:

- 12 month construction scenario, spread over up to 18 months;
- Will consist of erection and installation of relevant equipment to facilitate connection of the 400 kV cables to the NGET infrastructure. The maximum total impermeable area of the new equipment will be 0.17 hectares, which is approximately 4% of the area of the existing compound;
- The critical equipment flood raising criteria of 2.69 metres AOD or 0.8 metres above ground level, whichever is the highest; and,
- A Temporary Construction Compound (TCC 26).

7.12 Potentially relevant changes to the design envelope scenario are as follows:

- **Length of construction time:** The construction will be spread over 24 months rather than 18 months.
- **Proximity to watercourses:** There is no material change to the proximity of the Unlicensed Works to local water courses.
- **Maximum total impermeable area to be installed:** The proportion of impermeable area compared to the total area of the compound is no longer an appropriate measure of the influence of this new equipment as the total area of the compound will change, due to the Substation Extension Works, but this value is not yet known.
- **Critical equipment flood raising criteria:** Flood raising criteria of the Enabling Works at the Substation Extension Works site location is unknown.
- **Size and location of TCC26:** TCC26 has been reduced in total area, from 1.2ha to 0.8ha.

7.13 The changes highlighted in Paragraph 7.12 are not expected to significantly alter the hydrology or flood risk impacts, compared to the original assessment undertaken for the ES. Therefore, no alterations to the impact assessment overall results are required. A summary of the re-assessment is described in Annex 1, Table 5.

#### **Environmental assessment: Cumulative impacts**

7.14 Cumulative effects are effects that could arise as the result of more than one development at the same time. The assessment in Chapter 7 of the ES considered the past, present and reasonably foreseeable projects, programmes or plans that could result in an additive impact with TKES.

- 7.15 This scoping assessment identified that one of the projects, relating to the NGET Substation Enabling Works has been altered since the ES was submitted. The NGET Substation Extension Works and NGET Enabling Works at the NGET substation are both considered in the updated assessment of cumulative impacts.
- 7.16 The cumulative projects now considered in this assessment of cumulative impacts are described in Table 4 below.
- 7.17 In Chapter 7 of the ES, the maximum adverse scenario for the cumulative environmental impact assessment included the NGET Enabling Works at the NGET substation in three out of four of the potential impact pathways (highlighted in bold):
- **Simultaneous construction may affect surface water drainage**
  - **Simultaneous construction may affect flood risk**
  - **Simultaneous construction may affect surface water quality**
  - Simultaneous operation may affect surface water drainage, flood risk, water quality.
- 7.18 In this assessment, the NGET Substation Extension Works project is also included in the final potential impact pathways, *Simultaneous operation may affect surface water drainage, flood risk, water quality*. This is because the NGET Substation Extension Works permanently alter the hydrological regime in the area to be extended into; from green field site, to developed site.
- 7.19 Consideration of the works required to connect the TKOWF to the National Grid as two separate projects is not expected to significantly alter the hydrology or flood risk cumulative impacts, compared to the original assessment undertaken for the ES, as the specification of the works required has not materially altered with respect to the first three cumulative impacts.
- 7.20 It is anticipated that the addition of the NGET Substation Extension Works to the *Simultaneous operation may affect surface water drainage, flood risk, water quality* cumulative impact would also not significantly alter the results of this cumulative impact assessment because it is anticipated that the drainage of the site will be appropriately managed to account for run-off and water quality. No further impacts on flood risk during operation are anticipated from the change in location of the equipment that is to be installed.
- 7.21 As a result, no alterations to the impact assessment overall results are required. A summary of the re-assessment is described in Annex 1, Table 6.

**Table 4: Update to short-listed cumulative impact project/ plans.**

Tier	Status / Decision	Application ref.	Project/ Plan	Distance from TKES	Approximate estimated dates of construction/ operation (as applicable)	Potential overlap with TKES (construction phase)	Potential overall with TKES (operation phase)
2	The NGET Substation Extension Works  Permitted development at the , NGET substation.	NGET Substation, Bicker Fen	Works needed to extend the footprint of the existing NGET Bicker Fen Substation at the north eastern boundary to accommodate additional transmission system reinforcements to the existing network in order to accommodate further third party connections. NGET is responsible for the Substation Extension Works	0 km	Construction: 2015/2016  Operation: 2023	Yes	Yes

Tier	Status / Decision	Application ref.	Project/ Plan	Distance from TKES	Approximate estimated dates of construction/ operation (as applicable)	Potential overlap with TKES (construction phase)	Potential overall with TKES (operation phase)
2	The NGET Enabling Works Permitted development at the NGET substation.	NGET Substation, Bicker Fen	Works that NGET will need to undertake either within its existing footprint of the Bicker Fen Substation or within the extension to the existing NGET substation in order to connect the Triton Knoll Offshore Wind Farm to the national grid. The NGET Enabling Works include the creation of two new connection skeleton bays at the Bicker Fen substation including the installation of new switchgear and busbars and associated earthworks.	0 km	Construction: 2015/2016 Operation: 2023	Yes	Yes

Tier	Status / Decision	Application ref.	Project/ Plan	Distance from TKES	Approximate estimated dates of construction/ operation (as applicable)	Potential overlap with TKES (construction phase)	Potential overall with TKES (operation phase)
			<p>NGET is responsible for the Enabling Works under the terms of its transmission licence and grid connection agreement with TKOWFL.</p>				

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## Mitigation

7.22 All suggested mitigation measures as discussed above and in Table 3 are to be embedded into the design of the proposed development with respect to the changes to the Unlicensed Works, Substation Extension Works and Enabling works and agreed with the relevant authority.

7.23 No flood storage compensation measures are proposed.

## Review of Flood Risk Assessment (FRA)

7.24 In the Flood Risk Assessment for the ES (application document 6.2.5.7.3), there are two critical aspects of the FRA that need to be considered with respect to the components of this review:

- Flood raising criteria
- Drainage strategy

7.25 Figures 3-4 and 4-2 of the FRA have been edited to reflect the changes to the NGET Substation Extension Works, NGET Enabling Works and TKES Unlicensed Works. The updated (REV01) figures are at Appendix B, Annex 4.

### Flood raising criteria

7.26 The NGET Substation Extension Works site is immediately adjacent to the existing National Grid Bicker Fen substation. The topography in this part of the country is relatively homogenous and the existing substation equipment is raised to 2.6 metres AOD. It is therefore considered appropriate to keep the flood raising criteria originally specified in the FRA (and subsequently referenced in Chapter 7 of the ES) i.e. the equipment installed as part of the Unlicensed Works at the Bicker Fen Substation be raised to a level of 2.69 metres AOD or 0.8 metres above ground level, whichever is the highest. It is assumed that the equipment installed as part of the Enabling Works will be installed at 2.69 metres AOD or higher. However, NGET is responsible for these works and they do not form part of the Authorised Development within the proposed draft DCO for TKES.

### Drainage strategy

7.27 The new site for the NGET Substation Extension Works is currently a greenfield site. NGET will be responsible for the development of this site. It is assumed that NGET will be required to manage run-off from the extension site in the same manner as TKES are responsible for managing run-off at the TKES Substation and TKES Intermediate Electrical Compound sites. It is therefore also assumed that a drainage strategy will be put in place for the NGET Substation Extension Works and NGET Enabling Works, but the details of such a strategy is not yet known.

- 7.28 It is anticipated that the drainage strategy for the TKES Unlicensed Works will be designed to complement the NGET Substation Extension Works and NGET Enabling Works at the NGET substation site. However, given that the location of the NGET Substation Extension Works is currently a greenfield site and NGET's strategy on drainage is unknown, this analysis provides information on a potential strategy for drainage for the site, including the TKES Unlicensed Works, based upon the strategy used for both the TKES Substation and Intermediate Electrical Compound sites.
- 7.29 On the basis of those assumptions it would be expected that the rate of runoff from the impermeable areas of the site is limited to 1.05 l/s/ha (see Annex 2 of this document for the calculations) or a *de minimis* rate of 5 l/s (as defined by Black Sluice IDB for the Triton Knoll Substation site).
- 7.30 At the TKES Substation and the Intermediate Electrical Compound of the proposed development, storage is provided to attenuate the runoff rate from the developed site in the voids of the gravel surface beneath the equipment. In order to prevent outflow from the gravel to surrounding areas, a bund would be provided around the external perimeter of the gravel area with a small (100-300 mm) freeboard above the gravel level. All stored water would be retained on site and discharged via infiltration and/or via a flow-controlled outfall to an IDB watercourse (whichever option was deemed most appropriate following infiltration tests that would take place after development consent has been granted).
- 7.31 Using the drainage approach described in paragraph 7.30 above, the surface water storage requirement for runoff for the NGET Substation Extension Works, NGET Enabling Works and TKES Unlicensed Works is estimated as 547 m<sup>3</sup>, with the Unlicensed Works contributing approximately 30%. The proposed depth of gravel in the compound is 700 mm. With a 30% voids ratio, the volume of storage provided by the gravel area is 1,323 m<sup>3</sup> (see Annex 2 of this document for the calculations).
- 7.32 It is stressed that the storage requirements provided are estimated for the whole of the extension site, including the NGET Substation Extension Works, NGET Enabling Works and the TKES Unlicensed Works. The drainage for the TKES Unlicensed Works will have to complement the NGET Substation Extension Works and NGET Enabling Works which, will largely be constructed first.
- 7.33 Summary of changes to the FRA review of the original hydrology and flood risk assessment is summarised in Annex 1, Table 7.

### Summary of effects

- 7.34 The assessment has indicated that there are no significant adverse effects arising from the proposed development assuming that the implementation of the proposed

embedded mitigation measures outlined in paragraph 7.75 and Table 7-10 of the Volume 3, Chapter 7 *Hydrology and Flood Risk* of the ES, and reiterated in Table 3 here, are undertaken in full.

## ANNEX 1

**Table 1: Scoping Review of Impact Assessment due to Amended Unlicensed Works**

Topic	Change to the Proposed Development	Changes to outcome of the impact assessment
Chapter 2: Landscape and Visual	<p>The original assessment identified that the Unlicensed Works would be located within the boundary of the existing Bicker Fen substation.</p> <p>Based on the potential NGET Substation Extension Works, the TKES Unlicensed Works will be located within the boundary of the existing Bicker Fen substation and/or within the extension to the NGET substation.</p> <p>The original assessment identified that TCC 26 would be located directly adjacent to the construction operations and within the wider existing substation compound.</p> <p>Based on the Substation Extension Works, TCC26 will be located further north within the cable route corridor.</p>	Potential change to assessment of TKES Unlicensed Works. More detailed consideration of potential changes required.
Chapter 3: Socio-economics, Tourism and Recreation	The original assessment identified that the TKES Unlicensed Works would be located within the boundary of the existing Bicker Fen	None

Topic	Change to the Proposed Development	Changes to outcome of the impact assessment
	<p>substation.</p> <p>Based on the potential NGET Substation Extension Works, the TKES Unlicensed Works will be located within the boundary of the existing Bicker Fen substation and/or extended substation boundary.</p>	
Chapter 4: Terrestrial Ecology	No change – no specific details of TKES Unlicensed Works or TCC 26 identified.	None
Chapter 5: Land Use, Soils and Agriculture	No change – no specific mention of Unlicensed Works or TCC 26.	None
Chapter 6: Geology, Hydrogeology and Ground Conditions	<p>The original assessment identified that the installation of the TKES Unlicensed Works will require 12 months spread over up to 18 months; and that two bays are to be constructed.</p> <p>Based on the NGET Enabling Works and the proposed NGET Substation Extension, installation of the TKES Unlicensed Works will require 12 months spread over up to 24 months; two bays will be constructed, either within the southern search area of 0.7 ha or the northern search area of 2 ha.</p> <p>The original assessment</p>	None

Topic	Change to the Proposed Development	Changes to outcome of the impact assessment
	assumed TCC 26 of 1.2 ha. Based on the Substation Extension Works, TCC will comprise two areas (0.5 ha and 0.3 ha) totalling approximately 0.8 ha.	
Chapter 7: Hydrology and Flood Risk and Flood Risk Assessment	<p>The original assessment identified that the TKES Unlicensed Works would be located within the boundary of the existing Bicker Fen substation.</p> <p>Based on the NGET Substation Extension Works, the TKES Unlicensed Works will be located within the boundary of the existing Bicker Fen substation and/or extended substation boundary.</p>	Potential change to assessment of Unlicensed Works. More detailed consideration of potential changes required.
Chapter 8: Historic Environment	<p>The original assessment identified that the TKES Unlicensed Works would be located within the boundary of the existing NGET Bicker Fen substation.</p> <p>Based on the NGET Substation Extension Works, the TKES Unlicensed Works will be located within the boundary of the existing NGET Bicker Fen substation and/or extended substation boundary.</p>	None
Chapter 9: Traffic and	The original assessment identified that TCC 26 would	None

Topic	Change to the Proposed Development	Changes to outcome of the impact assessment
Access	<p>be adjacent to the existing NGET Bicker Fen Substation.</p> <p>Based on the NGET Substation Extension Works, TCC26 will be located further north within the cable route corridor.</p> <p>There is no change to the traffic volumes associated with the Unlicensed Works as a result of the NGET Enabling Works and NGET Substation Extension Works.</p>	
Chapter 10: Air Quality and Annex 10.2 Air Quality Assessment	<p>The original assessment identified that the TKES Unlicensed Works would be located within the boundary of the existing Bicker Fen substation.</p> <p>Based on the NGET Substation Extension Works, the TKES Unlicensed Works will be located within the boundary of the existing NGET Bicker Fen substation and/or extended substation boundary.</p> <p>The original assessment identified that TCC 26 would be located directly adjacent to the construction operations and within the existing NGET substation compound.</p>	None

Topic	Change to the Proposed Development	Changes to outcome of the impact assessment
	Based on the NGET Substation Extension Works, TCC26 will be located further north within the cable route corridor.	
Chapter 11: Noise and Vibration	<p>The original assessment considered noise from the TCCs on a worst case basis across all TCCs, with a minimum separation distance of 50 m considered in the noise assessment. Both the previous and new location of TCC 26 are at a distance of approximately 910 m from the nearest residential property (Kingstree Cottage), therefore the noise and vibration impact of TCC 26 remains unchanged.</p> <p>The potential locations of the TKES Unlicensed Works have moved slightly closer to Kingstree Cottage, from a distance of approximately 950 m to approximately 910 m. However, this change in distance would result in less than 1 dB change in predicted noise levels, therefore the conclusions of the noise and vibration assessment remain unchanged.</p>	None

**Table 2: Scoping Review of Cumulative Impact Assessment due to Enabling Works and Substation Extension Works**

Topic	Change to future projects	Changes to outcome of the assessment
Chapter 2: Landscape and Visual	Description of NGET Enabling Works (Ref 68) in Table 2-28 remains valid. However, NGET works will now include a Substation Extension Works.	Potential change to cumulative landscape and visual assessment. More detailed consideration of potential changes required.
Chapter 3: Socio-economics, Tourism and Recreation	Description of Enabling Works (Ref 68) in Table 3-10 remains valid. However, NGET works will now include the Substation Extension Works.	None
Chapter 4: Terrestrial Ecology	Description of Enabling Works (Ref 68) in Table 4-31 remains valid. However, National Grid works will now include the Substation Extension Works.	None
Chapter 5: Land Use, Soils and Agriculture	Description of Enabling Works (Ref 68) in Table 5-8 remains valid. However, National Grid works will now include the Substation Extension Works.	None
Chapter 6: Geology, Hydrogeology and Ground Conditions	N/A - cumulative scoped out	N/A - cumulative scoped out
Chapter 7: Hydrology and Flood Risk	Description of Enabling Works (Ref 68) in Table 7-13 remains valid. However, National Grid works will now include the Substation	Potential change to assessment of Substation Extension Works and Enabling Works. More detailed consideration of

Topic	Change to future projects	Changes to outcome of the assessment
	Extension Works.	potential changes required.
Chapter 8: Historic Environment	Description of Enabling Works (Ref 68) in Table 8-9 remains valid. However, National Grid works will now include the Substation Extension Works.	None
Chapter 9: Traffic and Access	Description of Enabling Works (Ref 68) in Table 9-18 remains valid. The original assessment considered 20 LGVs and 24 HGVs movements per day from the Enabling Works. NGET works will now include the Substation Extension Works.	National Grid has provided updated estimates for construction traffic volumes associated with the NGET Enabling Works and NGET Substation Extension Works.  Recalculation of cumulative traffic volumes is required to identify any potential changes to the cumulative traffic assessment.
Chapter 10: Air Quality	Description of Enabling Works (Ref 68) in Table 10-8 remains valid. However, NGET works will now include the Substation Extension Works.	None
Chapter 11: Noise and Vibration	Description of NGET Enabling Works (Ref 68) in Table 9-11 remains valid. However, National Grid works will now include the Substation Extension Works.	None

**Table 3: Review of the original landscape and visual assessment during construction and operation – Unlicensed Works**

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 2 of the ES)	Review of Assessment	Alteration to original assessment?
Landscape Assessment			
Landscape – Construction	Paras. 2.336 to 2.343	<p>The original construction assessment identified a <b>Minor Adverse</b> level of effect which is <b>Not Significant</b>.</p> <p>The original assessment identified that the temporary construction compound will be located in the northern extent of the NGET substation site. This remains the case however, the compound will be located slightly further north just outside the existing fence boundary and within the proposed cable route boundary.</p> <p>Given that the alternate location of the compound is the only change to the proposed construction methods, and that the compound will be located within close proximity to the existing substation site, the degree of landscape change remains as Low.</p> <p>The original assessment therefore remains valid, i.e. a <b>Minor Adverse</b> level of effect which is <b>Not Significant</b>.</p>	No alteration
Landscape – Operation Year 1	Paras. 2.680 to 2.688	<p>The original operational assessment identified a <b>Minor Adverse</b> level of effect which is <b>Not Significant</b>.</p> <p>The original assessment identified that the</p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 2 of the ES)	Review of Assessment	Alteration to original assessment?
		<p>degree of change to the host character area is limited by the presence of existing above ground electrical infrastructure within the site. The assessment of a larger extension to the north-eastern part of the substation site than was considered in the original LVIA has a minimal effect on the assessment.</p> <p>Given that the development remains as a limited increase in the existing infrastructure, the degree of landscape change remains as Low.</p> <p>The original assessment therefore remains valid, i.e. a <b>Minor Adverse</b> level of effect which is <b>Not Significant</b>.</p>	
Landscape – Operation Year 15	No mitigation is proposed and therefore no Year 15 assessment is provided.		
Visual			
Viewpoint 1 – Construction	Paras. 2.348 to 2.353	<p>The original construction assessment identified a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p> <p>This viewpoint looks in a north, north-easterly direction and would have a very limited view of the position of the construction compound in the north-eastern part of the site, i.e. it would not perceive the change to this part of</p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 2 of the ES)	Review of Assessment	Alteration to original assessment?
		<p>the site.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p>	
Viewpoint 1 – Operation Year 1	Paras. 2.692 to 2.697	<p>The original operational assessment identified a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p> <p>This viewpoint looks in a north, north-easterly direction and would not perceive the increased extent of infrastructure which would be located in the north-eastern part of the site, i.e. the existing infrastructure would screen the changes.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p>	No alteration
Viewpoint 1 – Operation Year 15	No mitigation is proposed and therefore no Year 15 assessment is provided.		
Viewpoint 2 – Construction	Paras. 2.354 to 2.360	<p>The original construction assessment identified a <b>Minor Adverse</b> level of effect which is <b>Not Significant</b>.</p> <p>This viewpoint looks in a south-easterly direction and potentially would have a view of the construction compound in its new position in the north-eastern part of the site. However, intervening screening is likely to limit the view</p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 2 of the ES)	Review of Assessment	Alteration to original assessment?
		<p>of the construction compound and it remains that the existing view includes a proliferation of visually dominant electrical infrastructure features particularly close to the site, i.e. large scale wind turbines, pylons and wooden post transmission lines, all of which limit the degree of change to the view that will occur due to the construction.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p>	
Viewpoint 2 – Operation Year 1	Paras. 2.698 to 2.704	<p>The original operational assessment identified a <b>Minor Adverse</b> level of effect which is <b>Not Significant</b>.</p> <p>This viewpoint looks in a south-easterly direction and has the potential to perceive the increased extent of infrastructure which would be located in the north-eastern part of the site, i.e. the existing infrastructure would screen the changes.</p> <p>However, it remains that the lower level of the proposed development would likely be screened by intervening trees and by the existing Substation itself. In addition, the distance from the site is 1.4 km and the existing view does include visually dominant electrical infrastructure features, i.e. large scale wind turbines, pylons and wooden post transmission lines, which limit the degree of change to the view that will occur due to the</p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 2 of the ES)	Review of Assessment	Alteration to original assessment?
		<p>Proposed Development.</p> <p>The original assessment therefore remains valid, i.e. a <b>Minor Adverse</b> level of effect which is <b>Not Significant</b>.</p>	
Viewpoint 2 – Operation Year 15	No mitigation is proposed and therefore no Year 15 assessment is provided.		
Viewpoint 4 – Construction	Paras. 2.361 to 2.366	<p>The original construction assessment identified a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p> <p>This viewpoint looks in a southerly direction and has the potential to view the construction compound in its new position in the north-eastern part of the site. However, intervening screening will likely screen the compound, particularly at a distance of 3.1 km from the NGET site.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p>	No alteration
Viewpoint 4 – Operation Year 1	Paras. 2.705 to 2.710	<p>The original operational assessment identified a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p> <p>This viewpoint looks in a southerly direction and has the potential to view the increased extent of the proposed development in the</p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 2 of the ES)	Review of Assessment	Alteration to original assessment?
		<p>north-eastern part of the site. However, intervening screening will likely screen the development, particularly at a distance of 3.1 km from the NGET site.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p>	
Viewpoint 4 – Operation Year 15	No mitigation is proposed and therefore no Year 15 assessment is provided.		
Viewpoint 5 – Construction	Paras. 2.367 to 2.372	<p>The original construction assessment identified a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p> <p>This viewpoint looks in a south-westerly direction and has the potential to view the construction compound in its new position in the north-eastern part of the site. However, intervening screening will likely screen the compound, particularly at a distance of 3.0 km from the NGET site.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p>	No alteration
Viewpoint 5 – Operation Year 1	Paras. 2.711 to 2.716	<p>The original operational assessment identified a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p> <p>This viewpoint looks in a south-westerly</p>	

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 2 of the ES)	Review of Assessment	Alteration to original assessment?
		<p>direction and has the potential to view the increased extent of the proposed development in the north-eastern part of the site. However, intervening screening will likely screen the development, particularly at a distance of 3.0 km from the NGET site.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p>	
Viewpoint 5 – Operation Year 15	No mitigation is proposed and therefore no Year 15 assessment is provided.		
Viewpoint 6 – Construction	Paras. 2.373 to 2.378	<p>The original construction assessment identified a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p> <p>This viewpoint looks in a south-westerly direction and has the potential to view the construction compound in its new position in the north-eastern part of the site. However, intervening screening will likely screen the compound.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p>	No alteration
Viewpoint 6 – Operation Year 1	Paras. 2.717 to 2.722	The original operational assessment identified a <b>Negligible</b> level of effect which is <b>Not Significant</b> .	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 2 of the ES)	Review of Assessment	Alteration to original assessment?
		<p>This viewpoint looks in a south-westerly direction and has the potential to view the increased extent of the proposed development in the north-eastern part of the site. However, intervening screening will likely screen the increased extent of the development.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p>	
Viewpoint 6 – Operation Year 15	No mitigation is proposed and therefore no Year 15 assessment is provided.		
Viewpoint 7 – Construction	Paras. 2.379 to 2.383	<p>The original construction assessment identified a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p> <p>This viewpoint looks in a north-westerly direction and has the potential to view the construction compound in its new position in the north-eastern part of the site. However, intervening screening will likely screen the compound.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p>	
Viewpoint 7 – Operation	Paras. 2.723 to 2.727	The original operational assessment identified a <b>Negligible</b> level of effect which is	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 2 of the ES)	Review of Assessment	Alteration to original assessment?
Year 1		<p><b>Not Significant.</b></p> <p>This viewpoint looks in a north-westerly direction and has the theoretical potential to view the increased extent of the proposed development in the north-eastern part of the site. However, intervening screening will likely screen the development.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant.</b></p>	
Viewpoint 7 – Operation Year 15	No mitigation is proposed and therefore no Year 15 assessment is provided.		
Viewpoint 8 – Construction	Paras. 2.384 to 2.389	<p>The original construction assessment identified a <b>Negligible</b> level of effect which is <b>Not Significant.</b></p> <p>This viewpoint looks in a westerly direction and has the potential to view the construction compound in its new position in the north-eastern part of the site. However, intervening screening will likely screen the compound, particularly at a distance of 2.6 km from the NGET site.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant.</b></p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 2 of the ES)	Review of Assessment	Alteration to original assessment?
Viewpoint 8 – Operation Year 1	Paras. 2.728 to 2.733	<p>The original operational assessment identified a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p> <p>This viewpoint looks in a westerly direction and has the potential to view the increased extent of the proposed development in the north-eastern part of the site. However, intervening screening will likely screen the increased extent of the development.</p> <p>The original assessment therefore remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p>	No alteration
Viewpoint 8 – Operation Year 15	No mitigation is proposed and therefore no Year 15 assessment is provided.		

Table 4: Review of the original cumulative traffic and transport assessment

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 9 of the ES)	Review of Assessment	Alteration to original assessment?
Traffic and Transport Assessment			
Cumulative traffic flows	Paras. 9.184 to 9.187	<p>The original assessment identified a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p> <p>The assessment of the updated construction traffic flows indicates that the difference in traffic volumes of LGVs and HGVs compared to those in the original assessment is not substantial enough that it changes any of the considerations that resulted in the original conclusions regarding traffic and transport effects.</p> <p>The original assessment remains valid, i.e. a <b>Negligible</b> level of effect which is <b>Not Significant</b>.</p>	No alteration

**Table 5: Review of the original Hydrology and Flood Risk assessment chapter with respect to the Unlicensed Works**

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 7 of the ES)	Review of Assessment	Alteration to original assessment?
Hydrology and Flood Risk Assessment Chapter 7			
Construction may affect flood risk	Paras. 7.109 to 7.117	<p>The original assessment identified <b>medium sensitivity</b> of the potential receptors and a <b>very low magnitude</b> of impact resulting in a <b>negligible</b> effect that is not significant.</p> <p>The construction duration will have very little influence on the magnitude of the assessment. The construction time is still less than the construction time of the substation itself, which is located nearby.</p> <p>The mechanisms by which the unlicensed works may have adverse influences remain the same as per paragraphs 7.111 and 7.114 of Volume 3 Chapter 7 of the ES.</p> <p>The new location of TCC26 is in the same Flood Zone (3) as the previous location for the TCC. Fluvial flooding is a significant hazard. Based upon the relevant flood mapping, tidal, surface water and groundwater flooding are not currently considered to be significant hazards.</p> <p>All embedded mitigation measures, as per paragraph 7.113 of Volume 3 Chapter 7 of the ES remain unchanged.</p> <p>The potential receptors and potential magnitude</p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 7 of the ES)	Review of Assessment	Alteration to original assessment?
		<p>of impacts are the same as paragraphs 7.115 and 7.116 of Volume 3 Chapter 7 of the ES.</p> <p>The original assessment remains valid, i.e. <b>medium sensitivity</b> of the potential receptors and a <b>very low magnitude</b> of impact resulting in a <b>negligible</b> effect that is not significant.</p>	
Construction may affect surface water drainage	Paras. 7.160 to 7.167	<p>The original assessment identified <b>medium sensitivity</b> of the potential receptors and a <b>low magnitude</b> of impact resulting in a <b>negligible</b> effect that is not significant.</p> <p>The construction duration will have very little influence on the magnitude of the assessment. The construction time is still less than the construction time of the substation itself, which is located nearby.</p> <p>The mechanisms by which the Unlicensed Works may have adverse influences remain the same as per paragraphs 7.162 of Volume 3 Chapter 7 of the ES.</p> <p>All embedded mitigation measures, as per paragraph 7.164 of Volume 3 Chapter 7 of the ES remain unchanged.</p> <p>The potential receptors and potential magnitude of impacts are the same as paragraphs 7.165 and 7.166 of Volume 3 Chapter 7 of the ES.</p> <p>The original assessment remains valid, i.e.</p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 7 of the ES)	Review of Assessment	Alteration to original assessment?
		<p><b>medium sensitivity</b> of the potential receptors and a <b>low magnitude</b> of impact resulting in a <b>negligible</b> effect that is not significant.</p>	
<p>Construction may affect surface water quality</p>	<p>Paras. 7.213 to 7.220</p>	<p>The original assessment identified <b>medium sensitivity</b> of the potential receptors and a <b>medium magnitude</b> of impact resulting in a <b>minor</b> effect that is not significant.</p> <p>The construction duration will have very little influence on the magnitude of the assessment. The construction time is still less than the construction time of the substation itself, which is located nearby.</p> <p>The mechanisms by which the Unlicensed Works may have adverse influences remain the same as per paragraphs 7.215 and 7.216 of Volume 3 Chapter 7 of the ES.</p> <p>All embedded mitigation measures, as per paragraph 7.217 of Volume 3 Chapter 7 of the ES remain unchanged.</p> <p>The potential receptors and potential magnitude of impacts are the same as paragraphs 7.218 and 7.219 of Volume 3 Chapter 7 of the ES.</p> <p>The original assessment remains valid, i.e. <b>medium sensitivity</b> of the potential receptors and a <b>medium magnitude</b> of impact resulting in a <b>minor</b> effect that is not significant.</p>	<p>No alteration</p>

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 7 of the ES)	Review of Assessment	Alteration to original assessment?
Operation may affect the quality of surface watercourses	Paras. 7.248 to 7.256	<p>The original assessment identified <b>medium sensitivity</b> of the potential receptors and a <b>low magnitude</b> of impact resulting in a <b>negligible</b> effect that is not significant.</p> <p>The mechanisms by which the Unlicensed Works may have adverse influences remain the same as per paragraphs 7.250 to 7.252 of Volume 3 Chapter 7 of the ES.</p> <p>All embedded mitigation measures, as per paragraph 7.253 of Volume 3 Chapter 7 of the ES remain unchanged.</p> <p>The potential receptors and potential magnitude of impacts are the same as paragraphs 7.254 and 7.255 of Volume 3 Chapter 7 of the ES.</p> <p>The original assessment remains valid, i.e. <b>medium sensitivity</b> of the potential receptors and a <b>low magnitude</b> of impact resulting in a <b>negligible</b> effect that is not significant.</p>	No alteration
Operation may impact flood risk and surface water drainage	Paras. 7.283 to 7.291	<p>The original assessment identified <b>low sensitivity</b> of the potential receptors and a <b>low magnitude</b> of impact resulting in a <b>negligible</b> effect that is not significant.</p> <p>The mechanisms by which the Unlicensed Works may have adverse influences remain the same as per paragraphs 7.285 to 7.287 of Volume 3 Chapter 7 of the ES.</p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 7 of the ES)	Review of Assessment	Alteration to original assessment?
		<p>All embedded mitigation measures, as per paragraph 7.288 of Volume 3 Chapter 7 of the ES remain unchanged.</p> <p>The potential receptors and potential magnitude of impacts are the same as paragraphs 7.289 and 7.290 of Volume 3 Chapter 7 of the ES.</p> <p>The original assessment remains valid, i.e. <b>low sensitivity</b> of the potential receptors and a <b>low magnitude</b> of impact resulting in a <b>negligible</b> effect that is not significant.</p>	
Decommissioning may affect the quality of surface watercourses	Paras. 7.316 to 7.323	<p>The original assessment identified <b>medium sensitivity</b> of the potential receptors and a <b>medium magnitude</b> of impact resulting in a <b>minor</b> effect that is not significant.</p> <p>The mechanisms by which the Unlicensed Works may have adverse influences remain the same as per paragraphs 7.318 and 7.319 of Volume 3 Chapter 7 of the ES.</p> <p>All embedded mitigation measures, as per paragraph 7.320 of Volume 3 Chapter 7 of the ES remain unchanged.</p> <p>The potential receptors and potential magnitude of impacts are the same as paragraphs 7.321 and 7.322 of Volume 3 Chapter 7 of the ES.</p> <p>The original assessment remains valid, i.e. <b>medium sensitivity</b> of the potential receptors</p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 7 of the ES)	Review of Assessment	Alteration to original assessment?
		and a <b>medium magnitude</b> of impact resulting in a <b>minor</b> effect that is not significant.	

**Table 6: Review of the original Hydrology and Flood Risk assessment chapter with respect to the cumulative impact assessment and the NGET extension and enabling works projects**

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 7 of the ES)	Review of Cumulative Assessment	Alteration to original assessment?
Simultaneous construction may affect surface water drainage	Paras. 7.341 to 7.348	<p>The original assessment identified <b>medium sensitivity</b> of the potential receptors and a <b>medium magnitude</b> of impact resulting in a <b>minor</b> effect that is not significant.</p> <p>The mechanisms by which the Substation Extension Works and Enabling Works may have adverse influences remain the same as per paragraphs 7.343 and 7.344 of Volume 3 Chapter 7 of the ES.</p> <p>It is assumed that the NGET extension works and the Enabling works will mitigate their own impacts to the same level of scrutiny as is required for the TKES.</p> <p>The potential receptors and potential magnitude of impacts are the same as paragraph 7.346 of Volume 3 Chapter 7 of the ES.</p> <p>The original assessment remains valid, i.e. <b>medium sensitivity</b> of the potential receptors and a <b>medium magnitude</b> of impact resulting in a <b>minor</b> effect that is not significant.</p>	No alteration
Simultaneous construction may affect	Paras. 7.349 to 7.356	<p>The original assessment identified <b>medium sensitivity</b> of the potential receptors and a <b>medium magnitude</b> of impact resulting in a <b>minor</b> effect that is not significant.</p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 7 of the ES)	Review of Cumulative Assessment	Alteration to original assessment?
flood risk		<p>The mechanisms by which the Substation Extension Works and Enabling Works may have adverse influences remain the same as per paragraphs 7.351 and 7.352 of Volume 3 Chapter 7 of the ES.</p> <p>It is assumed that the Substation Extension Works and Enabling Works will mitigate their own impacts to the same level of scrutiny as is required for the TKES.</p> <p>The potential receptors and potential magnitude of impacts are the same as paragraph 7.354 of Volume 3 Chapter 7 of the ES.</p> <p>The original assessment remains valid, i.e. <b>medium sensitivity</b> of the potential receptors and a <b>medium magnitude</b> of impact resulting in a <b>minor</b> effect that is not significant.</p>	
Simultaneous construction may affect surface water quality	Paras. 7.357 to 7.364	<p>The original assessment identified <b>high sensitivity</b> of the potential receptors and a <b>medium magnitude</b> of impact resulting in a <b>minor</b> effect that is not significant.</p> <p>The mechanisms by which the Substation Extension Works and Enabling Works may have adverse influences remain the same as per paragraphs 7.359 and 7.360 of Volume 3 Chapter 7 of the ES.</p> <p>It is assumed that the NGET extension works and the Enabling works will mitigate their own</p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 7 of the ES)	Review of Cumulative Assessment	Alteration to original assessment?
		<p>impacts to the same level of scrutiny as is required for the TKES.</p> <p>The potential receptors and potential magnitude of impacts are the same as paragraph 7.362 of Volume 3 Chapter 7 of the ES. However, it should be noted that neither the NGET Extension nor the Enabling Works are in immediate proximity to any main WFD water courses.</p> <p>The original assessment remains valid, i.e. <b>high sensitivity</b> of the potential receptors and a <b>medium magnitude</b> of impact resulting in a <b>minor</b> effect that is not significant.</p>	
Simultaneous operation may affect surface water drainage, flood risk, water quality	Paras. 7.365 to 7.372	<p>The original assessment identified <b>high sensitivity</b> of the potential receptors and a <b>medium magnitude</b> of impact resulting in a <b>minor</b> effect that is not significant.</p> <p>The mechanisms by which the Substation Extension Works may have adverse influences are the same as those described in paragraphs 7.367 and 7.368 of Volume 3 Chapter 7 of the ES.</p> <p>It is assumed that the Substation Extension Works will mitigate their own impacts to the same level of scrutiny as is required for the TKES.</p> <p>The potential receptors and potential magnitude of impacts are the same as</p>	No alteration

Assessment Type	Reference to original ES assessment (Volume 3, Chapter 7 of the ES)	Review of Cumulative Assessment	Alteration to original assessment?
		<p>paragraph 7.367 of Volume 3 Chapter 7 of the ES.</p> <p>As area of the Substation Extension Works is very small in comparison to the flood plain, and the works are expected to embed mitigation measures to deal with surface water drainage and water quality issues, then the original assessment remains valid, i.e. <b>high sensitivity</b> of the potential receptors and a <b>medium magnitude</b> of impact resulting in a <b>minor</b> effect that is not significant.</p>	

Table 7: Review of the original Flood Risk Assessment Annex with respect to the Unlicensed Works

Assessment Type	Reference to original FRA annex (Document number 6.2.5.7.3)	Review of Assessment	Alteration to original assessment?
Site description: Proposed development	3.2.5	<p>The existing Flood Risk Assessment, states that <i>“Both the Enabling Works and the Unlicensed Works will be within the existing National Grid Bicker Fen substation fence line.”</i></p> <p>The Enabling Works may be built outside the existing National Grid Bicker Fen fence line but inside the Substation Extension Works fence line. The Unlicensed Works will be within the new fence line of the existing and extended National Grid Bicker Fen substation.</p>	Yes
Environment Agency Flood Zones	4.2.1	<p>The existing National Grid Bicker Fen substation lies within Flood Zone 3.</p> <p>The alterations to the development will not change this.</p>	No alteration
Environment Agency Flood Zones	4.4.6 and 4.4.10	<p>The flooding of the right floodplain of the South Forty Foot Drain spreads out over a wide area, with depths of between 0.2 and 0.4 metres at the Substation site and the existing National Grid Bicker Fen substation. There is no detailed modelling of the potential flood levels at the Bicker Fen Substation from Hammond Beck.</p> <p>The alterations to the development do not</p>	No alteration

Assessment Type	Reference to original FRA annex (Document number 6.2.5.7.3)	Review of Assessment	Alteration to original assessment?
		change the conclusions stated.	
Flood Risk Management	5.1.8	<p>The proposed new equipment to be installed at Bicker Fen substation must be raised above the estimated flood depth for the 0.1% (1 in 1000) annual probability event for 2115; plus an allowance for freeboard. This equates to 0.8 metres above ground level.</p> <p>National Grid's assessment for the same criteria equates to 2.69 metres AOD. Therefore, the proposed flood raising requirement for new equipment Bicker Fen substation was considered to be 2.69 metres AOD or 0.8 metres above ground level, whichever is the highest.</p> <p>As there are no detailed flood models in the vicinity of Bicker Fen substation, the flood raising criteria are appropriate for the new, adjacent, location of the Substation Extension Works site.</p>	No alteration
Flood Risk Assessment	5.2.9	<p><i>"The new equipment at the National Grid Bicker Fen substation will have a negligible impact on flood extents and depths. Furthermore, due to the lack of variation in topography, there are no higher areas of land to remove in order to create any additional flood volume storage. It is therefore considered that flood storage</i></p>	No alteration

Assessment Type	Reference to original FRA annex (Document number 6.2.5.7.3)	Review of Assessment	Alteration to original assessment?
		<p><i>compensation is not required at... the National Grid Bicker Fen substation site."</i></p> <p>This statement holds true despite the altered location of the Substation Extension Works, Enabling Works and Unlicensed Works due to the homogenous nature of the topography.</p>	
Drainage Strategy	6.2.26	<p>The maximum total impermeable area of the new equipment will be 0.17 hectares.</p> <p>Given that this was a relatively small increase in impermeable area on previously developed land, the proposal was to use the existing drainage arrangements to deal with the slight increase in run-off.</p> <p>The new location for the Enabling Works and Unlicensed Works covers areas which are currently a greenfield site. Therefore, new drainage arrangements will be required. Such arrangements will be made for the Substation Extension Works and Enabling Works first. The Unlicensed Works will follow. Thus, the Unlicensed Works will still need to complement the drainage arrangements for the Substation Extension Works and Enabling Works.</p> <p>These drainage arrangements are not yet known. Therefore, the approach for the Unlicensed Works has assumed that the</p>	Yes

Assessment Type	Reference to original FRA annex (Document number 6.2.5.7.3)	Review of Assessment	Alteration to original assessment?
		<p>arrangements will be akin to the strategy proposed at the Triton Knoll Intermediate Electrical Compound and the Substation sites.</p> <p>The surface water storage requirement for runoff for the Substation Extension Works, Enabling Works and Unlicensed Works is estimated as 547 m<sup>3</sup>, with the Unlicensed Works contributing approximately 30%. The proposed drainage strategy indicates that the extension of Bicker Fen substation would have a storage capacity of 1,323m<sup>3</sup> which would be more than sufficient to accommodate the surface water storage requirements.</p>	

## ANNEX 2

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### Drainage Calculations

Project	Triton Knoll FRA	Project No.	MAM5494	Sheet	1	of	7
		Calculation No.	1 (Release 2.0)				
Subject	SUDS calculations	Made by	LGB	Date	16/10/15		
		Checked by	AFT	Date	16/10/15		

Drainage calculations for the Bicker Fen substation. Calculations are conservative and assume no infiltration.

		Bicker Fen substation extension
<b>Site characteristics</b>	<b>Units</b>	
Total area within the order limits	ha	1.2
Impermeable area - total	ha	0.57
Impermeable roads	ha	0.12
Impermeable other elements	ha	0.45
Area of compound (total site area for drainage calculations)	m <sup>2</sup>	12000
Area of compound	ha	1.2
Area of gravel in compound (Area of compound minus impermeable area and roadside drainage area)	m <sup>2</sup>	6300
Depth of gravel	m	0.7
Percentage voids in gravel	%	30
Volume of storage in gravel	m <sup>3</sup>	1323
Urban creep factor		1
HOST class		N/A
SAAR	mm	558
SAAR + climate change	mm	725.4
SPR		0.30
SOIL type		2
Growth curve factor 1 year		0.87
Growth curve factor 30 year		2.45
Growth curve factor 100 year		3.56
<b>Calculation results – IH124</b>		
<b>Greenfield runoff rates</b>		
Qbar	l/s	1.26
1 in 1 year	l/s	1.09
1 in 30 years	l/s	3.08
1 in 100 years	l/s	4.48
1 in 100 years + 30% climate change	l/s	5.82
1 in 100 years + 54% climate change	l/s	6.90
Qbar	l/s/ha	1.05
1 in 1 year	l/s/ha	0.91
1 in 30 years	l/s/ha	2.57
1 in 100 years	l/s/ha	3.73
1 in 100 years + 30% climate change	l/s/ha	4.85
1 in 100 years + 54% climate change	l/s/ha	5.75

Project	Triton Knoll FRA	Project No.	MAM5494	Sheet	2	of	7
		Calculation No.	1 (Release 1.0)				
Subject	SUDS calculations	Made by	LGB	Date	16/10/15		
		Checked by	AFT	Date	16/10/15		

## Greenfield runoff rates calculations

For catchments less than 50 ha:

$$Q_{bar} \text{ (l/s)} = (1.08 \times (0.01 \times 50)^{0.89} \times SAAR^{1.17} \times SPR^{2.17}) \times (A / 50)$$

Example for IEC GIS E&W:

$$Q_{bar} = (1.08 \times (0.01 \times 50)^{0.89} \times 621^{1.17} \times 0.37^{2.17}) \times (1.4 / 50) = 3.498 \text{ l/s}$$

## UKCP09 climate change projections for change in rainfall intensity

Since the NPPF Technical Guidance has been superseded by the Planning Practice Guidance, the previous climate change allowance factors of 20% and 30% increase of rainfall according to the time horizon no longer apply. NPS EN-1 requires the application of UKCP09 climate change projections. For the purposes of these calculations, projections for the longest time period into the future provided by UKCP09 are applied. The medium and high emissions p50 and p90 probability levels are applied since these represent greater changes from present than the low emissions and p10 probability levels. It can be seen from the table below that projected change in winter rainfall presents more of an issue for potential flood risk than projected change in summer rainfall. For this reason, only the winter climate change projections are applied in the volume calculations, since this represents a worst case.

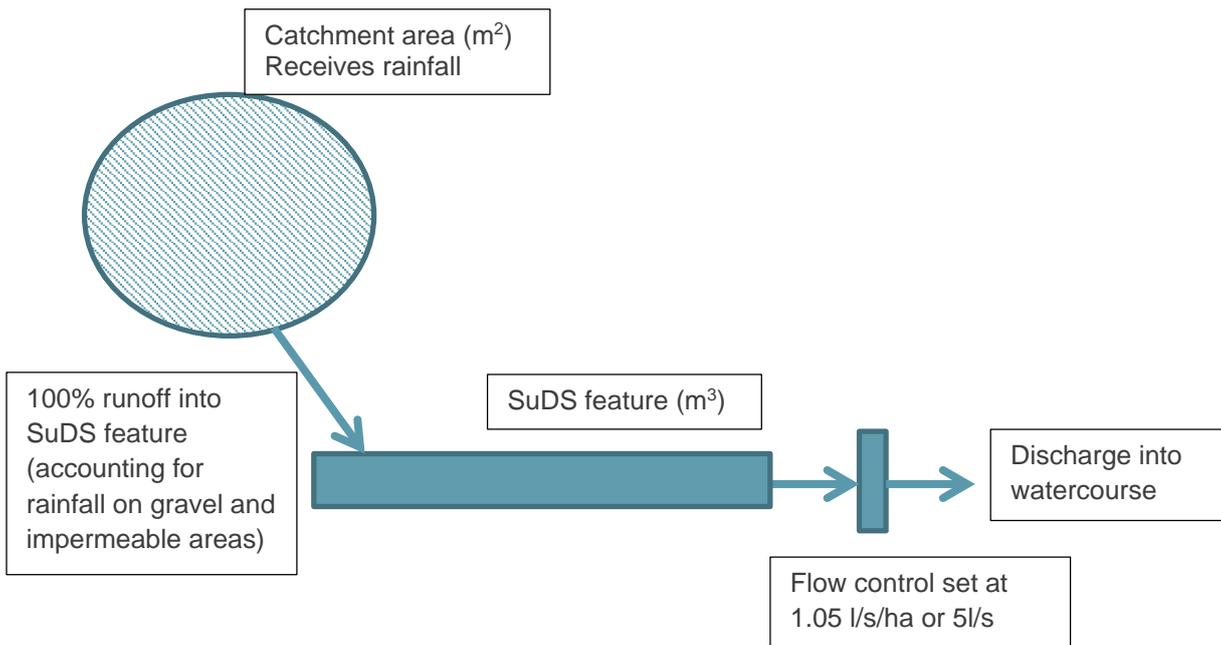
	Time slice	Emissions	P level	UKCP09 projections	Ref. in SuDS model
	Present day				CC00
<b>WINTER</b>				% increase in winter rainfall	
2085	2070 - 2099	High	P90	53.98	CC54
2085	2070 - 2099	High	P50	24.856	CC25
2085	2070 - 2099	Medium	P90	41.3	CC41
2085	2070 - 2099	Medium	P50	18.555	CC19
<b>SUMMER</b>					
2085	2070 - 2099	High	P90	4.006	
2085	2070 - 2099	High	P50	-25.059	
2085	2070 - 2099	Medium	P90	5.717	
2085	2070 - 2099	Medium	P50	-19.846	

Project	Triton Knoll FRA	Project No.	MAM5494	Sheet	3	of	7
		Calculation No.	1 (Release 1.0)				
Subject	SUDS calculations	Made by	LGB	Date	16/10/15		
		Checked by	AFT	Date	16/10/15		

## Storage volume requirement calculations

Calculations of storage volume requirements have been carried out with an InfoWorks CS model. The conceptual design is to store runoff within the compound in the voids of the gravel dressing the surface of the compound. The storage requirement is therefore for runoff from impermeable areas as well as from rainfall falling on the gravel itself. The SuDS storage of runoff within the gravel will attenuate runoff, which will then be allowed to infiltrate at pre-development infiltration rates across the whole of the gravel area and discharge to surface water via a flow controlled outfall. For the purposes of the model calculations, we assume that there will be no infiltration; which is a very pessimistic assumption since the soil types at both the Substation and Intermediate Electrical Compound sites suggest that infiltration will occur. The model therefore calculates the volume of runoff that must be stored for the critical duration storm, for both summer and winter, assuming the discharge rate of 1.05 l/s/ha or a *de-minimus* rate of 5 l/s.

Conceptual outline of model. Model used: InfoWorks CS 14.00.



Network name	Catchment size (ha)	SuDS feature (m <sup>3</sup> )	Flow control (l/s)
Substation Extension	1.2	1323	1.05 l/s/ha

Project	Triton Knoll FRA	Project No.	MAM5494	Sheet	4	of	7
		Calculation No.	1 (Release 1.0)				

Subject	SUDS calculations	Made by	LGB	Date	16/10/15
		Checked by	AFT	Date	16/10/15

## Results

<b><u>Extension to Bicker Fen Substation</u></b>		
	<b>SuDS volume (m<sup>3</sup>)</b>	<b>Compound area (m<sup>2</sup>)</b>
<b>IEC_GIS_E&amp;W</b>	1323	12000
<b>Critical duration</b>	2160 min	n/a
	<b>Flood depth above gravel M100 (mm)</b>	<b>Total storage volume requirement M100 (m<sup>3</sup>)</b>
IEC_GIS_E&W_Winter_CC00	0.00	547
IEC_GIS_E&W_Winter_CC54	0.00	884
IEC_GIS_E&W_Winter_CC41	0.00	803
IEC_GIS_E&W_Winter_CC25	0.00	702
IEC_GIS_E&W_Winter_CC19	0.00	665

Project	Triton Knoll FRA	Project No.	MAM5494	Sheet	5	of	7
		Calculation No.	1 (Release 1.0)				
Subject	SUDS calculations	Made by	LGB	Date	16/10/15		
		Checked by	AFT	Date	16/10/15		

## Conclusions

At the extension to the Bicker Fen Electrical substation the required storage volume does not exceed the available storage volume for any of the modelled event. Therefore, the modelling indicates that the compound will not flood during any of the event. The calculations are conservative and assume no infiltration.

# Calculation sheet

	Total storage volume (m <sup>3</sup> )								
<b>Extension Substation Winter CC00</b>									
	<u>15 min duration</u>	<u>30 min duration</u>	<u>60 min duration</u>	<u>180 min duration</u>	<u>360 min duration</u>	<u>720 min duration</u>	<u>1080 min duration</u>	<u>1440 min duration</u>	<u>2160 min duration</u>
max_volume_M10	102.96531	121.31345	142.4709	181.91443	209.56268	236.44186	257.83383	271.57571	288.58386
max_volume_M30	150.19528	174.31998	201.85831	252.60703	287.84549	322.6489	351.46228	370.60657	393.46274
max_volume_M100	225.83032	257.79736	293.74017	358.96387	403.90247	448.6597	487.2215	513.56885	546.72131
<b>Extension Substation Winter CC18</b>									
	<u>15 min duration</u>	<u>30 min duration</u>	<u>60 min duration</u>	<u>180 min duration</u>	<u>360 min duration</u>	<u>720 min duration</u>	<u>1080 min duration</u>	<u>1440 min duration</u>	<u>2160 min duration</u>
max_volume_M10	122.4694	144.2424	169.5793	217.2035	250.979	284.9211	312.4367	330.8834	353.6066
max_volume_M30	178.881	207.6661	240.5621	301.5601	344.4882	388.0207	424.5789	449.6588	481.415
max_volume_M100	268.9764	307.0834	350.0019	428.2749	482.8767	538.4161	586.7392	620.5657	665.015
<b>Extension Substation Winter CC24</b>									
	<u>15 min duration</u>	<u>30 min duration</u>	<u>60 min duration</u>	<u>180 min duration</u>	<u>360 min duration</u>	<u>720 min duration</u>	<u>1080 min duration</u>	<u>1440 min duration</u>	<u>2160 min duration</u>
max_volume_M10	128.629	151.5113	178.1857	228.3753	264.0955	300.289	329.7695	349.7225	374.5377
max_volume_M30	187.9464	218.2058	252.7987	317.0316	362.4083	408.7102	447.7324	474.7101	509.3385
max_volume_M100	282.6212	322.6436	367.7778	450.1725	507.8377	566.7983	618.2205	654.4264	702.483
<b>Extension Substation Winter CC41</b>									
	<u>15 min duration</u>	<u>30 min duration</u>	<u>60 min duration</u>	<u>180 min duration</u>	<u>360 min duration</u>	<u>720 min duration</u>	<u>1080 min duration</u>	<u>1440 min duration</u>	<u>2160 min duration</u>
max_volume_M10	145.0479	171.012	201.1713	258.2049	299.1305	341.3666	376.1241	400.1363	430.9955
max_volume_M30	212.1514	246.3146	285.4412	358.3188	410.2384	463.9616	509.5884	541.6574	584.0086
max_volume_M100	318.9617	364.1604	415.1761	508.5921	574.4338	642.5565	702.2723	744.8539	802.5922
<b>Extension Substation Winter CC53</b>									
	<u>15 min</u>	<u>30 min</u>	<u>60 min</u>	<u>180 min</u>	<u>360 min</u>	<u>720 min</u>	<u>1080 min</u>	<u>1440 min</u>	<u>2160 min</u>

# Calculation sheet

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	<u>duration</u>								
max_volume_M10	158.4558	186.8643	219.8713	282.4697	327.6537	374.8239	413.9011	441.2661	477.2649
max_volume_M30	231.8252	269.1645	311.9714	391.8863	449.1376	508.922	559.9432	596.1777	644.8874
max_volume_M100	348.5182	397.8832	453.6973	556.0723	628.5762	704.1951	770.6533	818.4441	884.1101