SCOTTISHPOWER RENEWABLES

Onshore Converter Station

Surface and Foul Water Drainage Management Plan

Requirement 18 (1) to (2) & 22 (1) to (2(a))

(Applicable to Work Numbers 62 to 69)

Prepared by:	Checked by:	Approved by:
Kay Griffin, SLR	Philip Rew-Williamson Digitally signed by: Philip Rew-Williamson DN: CN = Philip Rew-Williamson email = prew-williamson@scottishpower.com C = GB O = East Anglia THREE OU = Consents Date: 2022.04.19 15:26:10 Z	Gareth Mills Digitally signed by Gareth Mills Date: 2022.04.19 17:03:42 +01'00'

Revision Summary				
Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**
1	16/12/2020	Kay Griffin	Colin Bryans	David Boyd
2	24/01/2022	Kay Griffin	Phil Rew-Williamson	Gareth Mills
3	07/04/22	Kay Griffin	Phil Rew-Williamson	Gareth Mills

Description of Revisions			
Rev	**Page**	**Section**	**Description**
1	ALL	ALL	New Document
2	ALL	ALL	Revised in accordance with stakeholder comments (Environment Agency (15/02/21), SCC (24/02/21), ESIDB (25/01/21)
3	ALL	ALL	Revised in accordance with stakeholder comments (Environment Agency (04/03/22), SCC (17/2/22), ESIDB (04/03/22)

TABLE OF CONTENTS

FIGURES

1. INTRODUCTION AND SCOPE

1.1. Project Overview

1. East Anglia Three Limited (EATL) was awarded a Development Consent Order (DCO) by the Secretary of State, Department of Business, Energy and Industrial Strategy (DBEIS) on 7 August 2017 for the East Anglia THREE Offshore Windfarm (EA THREE). The DCO granted consent for the development of a 1,200MW offshore windfarm and associated infrastructure and is live until 28 August 2022.

2. The DCO has now been subject to three non-material variations:

- In March 2019 EATL submitted a non-material change application to DBEIS to amend the consent to increase the maximum generating capacity from 1,200MW to 1,400MW and to limit the maximum number of gravity base foundations to 100. In June 2019 DBEIS authorised the proposed change application and issued an Amendments Order.
- In July 2020 EATL submitted a second non-material change application to DBEIS to amend the parameters of its offshore substations (reducing the number of these to one) and wind turbines (a decrease in the number of turbines and an increase in their hub height and rotor radius). On 15 April 2021 DBEIS authorised this proposed change application and issued an Amendments Order.
- In August 2021 EATL submitted a third non-material change application to DBEIS to amend the consent to remove the maximum generating capacity of 1,400MW and to amend the parameters of its wind turbines (a decrease in the number of turbines and an increase in their hub height and rotor radius). The application is currently in the consultation phase.

3. The onshore construction works associated with EA THREE will have a capacity of 1,400MW and transmission connection of 1,320MW. The construction works will be spread across a 37km corridor between the Suffolk coast at Bawdsey and the converter station at Bramford, passing the northern side of Ipswich. As a result of the strategic approach taken, the cables will be pulled through pre-installed ducts laid during the onshore works for East Anglia ONE Offshore Windfarm (EA ONE), thereby substantially reducing the impacts of connecting to the National Grid (NG) at the same location. The infrastructure to be installed for EA THREE, therefore, comprises:

- The landfall site with one associated transition bay location with two transition bays containing the connection between the offshore and onshore cables;
- Two onshore electrical cables (single core);
- Up to 62 jointing bay locations each with up to two jointing bays;
- One onshore converter station, adjacent to the EA ONE Substation;
- Three cables to link the converter station to the National Grid Bramford Substation;
- Up to three onshore fibre optic cables; and
- Landscaping and tree planting around the onshore converter station location.

4. Since the granting of the DCO, the decision has been made that the electrical connection for EA THREE will comprise a high voltage direct current (HVDC) cable rather than a high voltage alternating current cable and, therefore, the type of substation that will be required is a HVDC converter station. The substation will, therefore, be referred to here as a 'converter station' and this amended terminology has been agreed with the relevant authorities on 15 October 2020. It has also been determined that only one converter station will be constructed rather than two and that the converter station will be installed in a single construction phase.

1.2. Purpose and Scope

5. This Surface and Foul Water Drainage Management Plan (SFWDMP) focuses on the procedures for managing the drainage with respect to the EA THREE onshore converter station. This document has been produced to fulfil DCO Requirement 18 which states:

> **Surface and foul water drainage**
> ***18.-—(****1) No stage of the connection works may commence until for that stage written details of the surface and (if any) foul water drainage system (including means of pollution control) have, after consultation with the relevant drainage authorities, Suffolk County Council and the Environment Agency, been submitted to and approved by the relevant planning authority.*
> *(2) The details agreed in paragraph (1) must accord with the proposals for a surface water and drainage management plan contained in the outline code of construction practice and include a surface water drainage scheme for Work No. 67, which is based on sustainable drainage principles and an assessment of the hydrological and hydrogeological context of the development.*
> *(3) The surface and foul water drainage system for the relevant stage must be constructed in accordance with the approved details.*

6. This document also fulfils part of DCO Requirement 22 which also requires a surface water and drainage management plan:

> ***Code of construction practice***
> ***22**.- (1) No stage of the connection works may commence until for that stage a code of construction practice (which must accord with the outline code of construction practice) has been submitted to and approved by the relevant local planning authority, in consultation with the relevant highway authority.*
> *(2) The code of construction practice must include—*
> *(a) a surface water and drainage management plan;*

7. The scope of this document relates to the SFWDMP associated with the construction of the onshore converter station works. Works in this stage comprise Work No.s 62 to 69, located to the north of the existing NG substation and adjacent to the EA ONE Substation (Figure 1 Site Context Plan). SFWDMPs have been produced for each stage of the onshore connection works and are provided under separate cover.

8. Construction works at the Converter Station will be some of the first onshore connection works to commence. The access track and temporary laydown will be constructed in Summer 2022 with the remaining works being undertaken from Q2 2023.

9. With respect to the converter station, it is Mid Suffolk District Council (MSDC) who is the relevant planning authority. However, EATL has acknowledged from an early stage that Suffolk County Council (SCC) (as the Lead Local Flood Authority), Babergh District Council (BDC) and the Environment Agency are important consultees in the process for the SFWDMP.

10. The purpose of the document is to describe the basis of the drainage scheme and management of water during construction and operation of the converter station stage. It also includes information on the Sustainable Drainage System (SuDS) measures adopted for the attenuation, conveying and treatment of surface water, waste water and foul water arising from the development.

11. The measures contained herein shall be adhered to by the Principal Contractor and the implementation and compliance will be monitored by the Construction Management Team. These measures will only be revised with the agreement of MSDC.

12. This plan should be read in conjunction with the CoCP and in particular the following:

- Section 14 Protection of Surface and Groundwater and also Section 14.5 Licences of CoCP. Watercourse Crossing Method Statement (Appendix 2 of CoCP)
- Pollution Prevention and Emergency Incident Response Plan (Appendix 7 of CoCP)
- Project Environmental Management Plan (Appendix 10 of CoCP)
- Flood Plan (Appendix 12 of CoCP)

13. A Water Framework Directive (WFD) Assessment has not been considered necessary for the construction of the onshore converter station stage, due to the proposed mitigation measures s outlined in this Surface Water and Drainage Management Plan, the Code of Construction Practice (EA3-OND-CNS-REP-IBR-000005) and the distance of the stage (approx. 1.5km to Belstead Brook and 2.2km to the River Gipping) from any water bodies that are classified under the Water Framework Directive.

2. ABBREVIATIONS

BDC	Babergh District Council
Chapter 8	Guidelines for (Public) Highways signing, lighting and guarding
CoCP	Code of Construction Practice
DBEIS	Department of Business, Energy and Industrial Strategy
DC	Direct Current
DCO	Development Consent Order
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EA ONE	East Anglia ONE
EA THREE	East Anglia THREE
EATL	East Anglia THREE Limited

EnvCoW	Environmental Clerk of Works
ES	Environmental Statement
GWD	Groundwater Directive (2006/118/EC, including amendments to Annex II detailed under
HVDC	High voltage direct current
LLFA	Lead Local Flood Authorities
MSDC	Mid Suffolk District Council
MW	Megawatt
NG	National Grid Plc
NPPF	National Planning Policy Framework
PPG	Pollution Prevention Guideline
RPS	Regulatory Position Statement
SCC	Suffolk County Council
SEPA	Scottish Environment Protection Agency
SPP	Suffolk SuDS Palette
SuDS	Sustainable Drainage System
WFD	Water Framework Directive (2000/60/EC)

3. SURFACE AND FOUL WATER DRAINAGE MANAGEMENT PLAN GOVERNANCE

14. Prior to the commencement of construction, an Environmental Clerk of Works (EnvCoW) will be appointed by the Principal Contractor to manage inter alia the implementation of the SFWMDP. Contact details for the EnvCoW will be submitted to stakeholders for their records prior to commencement of construction.

15. The EnvCoW will be responsible for ensuring that the effective surface water drainage management measures and that the Principal Contractor also has in place a plan and appropriate means to respond to unforeseen events. This forward planning and implementation are critical to the effective management of surface water during construction and is a key lesson learnt from the construction of the East Anglia ONE project.

16. Prior to commencement of construction and in accordance with the SCC Construction Surface Water Management Plan Template, the Principal Contractor will also provide the following details of their Accreditation (e.g. ISO) and Environmental Policies and also, with respect to other key roles, relating to this plan:

- Role;
- Contact;
- Company Name and Address;
- Contact number and email; and
- Key responsibilities.

4. CONSTRUCTION DETAILS

4.1. Enabling Works

17. The onshore construction works will commence with the enabling works, which comprises the establishment of the temporary laydown area (Work No 65) and the access to this from the existing EA ONE access road. The temporary laydown area will be directly northeast of the converter station and will include temporary offices, welfare, car parking, materials and equipment storage. At the start of the works the onshore converter station compound and temporary laydown area will be temporarily fenced in accordance with the Fencing and Enclosures Plan (EA3-GRD-CON-PLN-IBR-000106) and a security cabin will be installed at the main access gate.

18. Following any necessary ecological mitigation, topsoil will be stripped from the access road and temporary laydown area and stored at specific storage locations as to avoid cross contamination with other materials. Topsoil storage and management will be compliant with the recommendations and requirements set out in the Onshore Converter Station Landscape Management Plan (EA3- EA3-GRD-CON-PLN-IBR-000103). Topsoil will be stored to one side of the working area, in such a way that it is not mixed with any subsoil.

Typically this would be stored as an earth bund of a maximum height of two metres, to avoid compaction from the weight of the soil. Storage time will be kept to a minimum, to prevent the soil deteriorating in quality and the topsoil bunds seeded to prevent windblow. Topsoil stripped from different fields will be stored separately, as would soil from specific hedgerow banks or woodland strips.

19. The construction of an access road typically involves the placement of suitable graded imported stone material onto a suitable subgrade, potentially with a reinforcing geogrid and/or a geotextile, however other methods such as soil stabilisation may be used if considered appropriate. Following the initial topsoil stripping, the on-site access road will be installed for a width of 6m.

20. The enabling works will also include installation of surface water drainage for the access road and temporary laydown area, in accordance with the Surface Water and Drainage Management Plan (EA3-GRD-CON-PLN-IBR-000107). Foul water drainage during this initial period will be via portable welfare facilities, with a tank that will be emptied on a weekly or bi-weekly basis.

4.2. Construction

21. The EA THREE onshore converter station will be located within a fenced compound (maximum 157m by 186m) (Work No. 67), immediately to the east of the East Anglia ONE Substation and to the north of the existing NG Bramford Substation. The converter station will contain electrical equipment including power transformers, switchgear, reactive compensation equipment, harmonic filters, cables, lightning protection masts, control buildings, communications masts, backup generators, access, fencing and other associated equipment, structures or buildings. The converter station will have a compact layout, with the majority of the equipment contained in buildings not incongruous to their setting.

22. The construction of the converter station will comprise a number of key stages, including: platform upfill to finished level (approx. 54m AOD) foundations and building construction and equipment installation and commissioning.

23. The main site access has already been constructed as part of the EA ONE works, however, an internal service road from this will require installation.

24. The enabling works will include grading and earthworks to remove any unsuitable materials from the converter station area and to build up with suitable fill material to establish a formation level for the converter station construction. The materials excavated will be reused on site as engineering fill or landscaping depending on material properties.

25. Following the completion of the site grading, works will commence with the excavations for ducting and the foundations for the buildings and external plant. The building will largely comprise steel, concrete or masonry and cladding materials. The structural steelwork will be fabricated and prepared off site and delivered to site for erection activities using cranes. The composite or cassette cladding panels (e.g. Kingspan) will be delivered to site ready to erect and be fixed to the steelwork.

26. The civil works will be followed by the installation and commissioning of the electrical equipment. The large transformers will be filled on site. The smaller electrical components will be constructed on site using small mobile plant and lifting apparatus.

4.3. Cable Installation

27. Works No.s 63 and 66 will comprise the installation in open trenches of cables to connect the Converter Station to the nearby National Grid Bramford Substation. Construction activities for the installation of the cable in open trenches will be undertaken within a temporarily fenced strip of land, referred to as the working width.

28. The cable route into the Converter Station from Work No. 64 through Work No 63 was not known at the time of the preparation of the Environmental Statement and it was considered at that time that this may also be installed using open trenches. The ducts have now, however, been installed during the construction works for EA ONE to end within Work No. 67 (the converter station site). There will, therefore, be no requirement, as originally anticipated, to open trench these through Work no. 63 to the Converter Station.

29. Works in Work No. 62 will also include the installation of haul road to reach a jointing bay in the adjacent Work No. 58 (not part of this stage) to the east. This will follow the route of the EA ONE haul road as shown in Figure 2.

30. In addition, all ducts to be used for EA THREE, which were installed during the EA ONE construction works, will require to be 'proved' to ensure that they are intact and free of debris. This will generally be undertaken by the use of foam pigs driven under pressure from jointing bay to jointing bay. Each stretch of duct that was installed using HDD will, however, require duct-proving excavations

at each end to allow the use of different diameter foam pigs, due to a difference in the diameter of these compared to the ducting installed using open trench techniques.

5. SITE DETAILS

31. Figure 1 Site Context Plan provides an overview of the converter station location and temporary laydown area. Figure 3 shows the surface water features within the Converter Station Stage.

5.1. Hydrological and Hydrogeological Context

32. The converter station drainage strategy takes into account the existing hydrological and hydrogeological conditions of the site, as confirmed through site ground investigation undertaken in May-June 2021 (Structural Soils, 2021) and a topographic survey of the site (Appendix 3).

33. The converter station is to be constructed on the area used as the temporary laydown area for the construction of the EA ONE Substation. This area is consequently covered in hardstanding (crushed rock, Type 1). The ground investigation confirmed that beneath this the superficial deposits beneath the whole of the converter station are the Lowestoft Till. This is described as being stony, sandy clay, rich in chalk and flint pebbles and infiltration testing found this material to have a low permeability. Further infiltration testing, to be undertaken in line with the requirements of BRE365, will be carried out in the specific location and depth of the proposed SuDS pond; however, it is not expected that this will return significantly different results.

34. The underlying bed rock at the site is comprised of the Lambeth Group. During the ground investigation this was encountered at depths of 13 -15m below ground level and was typically described as a silt or a clay.

35. The site survey picked up two shallow (~1m deep) drainage ditches adjacent to the site. These are a ditch to the north of the site flowing from west to east and a ditch to the east of the site flowing from south to north. These ditches, which are typically dry, collect and convey excess runoff from the area of the proposed converter station during periods of intense rainfall. The two drains combine to the northeast of the site and flow away to the east. Ultimately this system of drains discharges to the River Gipping which is present 2.2km to the east of the site.

36. Ground drains and shallow surface channels are currently installed within the crushed rock layer at the surface of the site and discharge to a temporary pond. These were installed to prevent water logging while the land was being used as the temporary laydown area for the construction of the EA ONE Substation. These features, which do not serve any off-site areas, will all be removed prior to the start of the construction works for the converter station stage.

37. The temporary laydown area for EA THREE is to be located on an area of open arable fields to the northeast with no formal surface water drainage system. All runoff currently naturally infiltrates the ground, ponds on the surface or evaporates, or eventually runs into the adjacent field drainage ditch discharging away to the east. The haul road in Work No. 62 is also located on open arable fields with no formal surface water drainage system.

5.2. Risk of Flooding

38. A Flood Risk Assessment was conducted in 2015 by Royal HaskoningDHV and the findings of this were included in the Environmental Statement (Vol 3 Chapter 21 as Appendix 21.2). Reference was made to the Environment Agency (EA) Flood Zone Map, which was used to identify the flood risk potential for the location of the converter station.

39. The EA Flood Map identifies three categories of Flood Zones, which reflects the risk of an area being affected by flooding from either rivers or the sea, where there are no flood defences. The zones are described as follows:

- Flood Zone 1: land defined as having less than a 1 in 1000 annual probability of flooding from rivers or the sea);
- Flood Zone 2: land having between a 1 in 1000 and a 1 in 100 annual probability of flooding from rivers or between a 1 in 1000 and a 1 in 200 annual probability of flooding from the sea; and
- Flood Zone 3: land having greater than a 1 in 100 annual probability of flooding from rivers or greater than 1 in 200 annual probability from the sea.

40. Based on the EA Flood Zone Map (Figure 21.5 of the ES), the report confirmed that the converter station is fully located within Flood Zone 1 (i.e. a less than 1 in 1000 year annual probability of flooding from rivers or the sea) and therefore (according to EA criteria) is considered to have a 'Very Low' risk of flooding (equivalent to <0.1%). Current UK flood mapping[1] indicates that this remains the case. The closest areas of land mapped as being at risk of flooding are 2.8km to the east (associated with the River Gipping) and 1km to the west (associated with Belstead Brook).

6. RELEVANT STANDARDS AND LEGISLATION

41. The converter station stage drainage strategy has been developed in accordance with the following relevant standards and guidance.

6.1. British Standards / Eurocodes

- BS 752-4: 2008 Design of Drainage and Sewer Systems outside Buildings
- BS EN 858-1:2002 Separator Systems for Light Liquids (e.g. Oil & Petrol)
- BS EN 12056-3:2000 Gravity Drainage Systems Inside Buildings
- BS 8582:2013 Code of practice for surface water management for development sites.

6.2. Legislation and Planning Policy

- The Water Framework Directive (2000/60/EC) (WFD)
- The Groundwater Directive (2006/118/EC, including amendments to Annex II detailed under Directive 2014/80/EU) (GWD)
- The Floods Directive (2007/60/EC)
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 which transposes the WFD and aspects of the GWD into UK legislation
- The Groundwater (England and Wales) Regulations 2009 which implements in England and Wales Article 6 of the GWD which details measures to prevent or limit inputs of pollutants into groundwater The Flood Risk Regulations 2009 transposes the EU Floods Directive into UK legislation and sets out requirements of the Environment Agency and local authorities in preparing assessments and mapping of flood risk for each river basin district in England and Wales
- Flood and Water Management Act 2010 includes provisions for the management of risk in connection with flooding and sets out requirements for Lead Local Flood Authorities (LLFA) in preparing strategies for local flood risk management
- The Land Drainage Act 1991 and 1994
- The Environment Act 1995
- The Environmental Permitting (England and Wales) Regulations 2016 consolidate and replace the Environmental Permitting (England and Wales) Regulations 2010, which have been amended 15 times to date. The 2010 Regulations are still in force and are the main implementing regulations for the environmental permitting regime
- National Planning Policy Framework (NPPF)
- Mid Suffolk District Council Strategic Flood Risk Assessment, Mid Suffolk District Councils, March 2008
- Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems, March 2015, Department for Environment, Food and Rural Affairs.
- The Water Abstraction and Impounding (Exemptions) Regulations 2017.

6.3. CIRIA Guidance

- CIRIA C532 Control of Water Pollution from Construction Sites (2001)
- CIRIA C502 Environmental Good Practice on Site (2015)
- CIRIA C753 SuDS Manual (Dec 2015)
- CIRIA C762 Environmental Good Practice on Site (4th Edition 2016)
- CIRIA 648 Control of Water Pollution from Linear Construction Projects – Technical Guidance
- CIRIA 649 Control of Water Pollution from Linear Construction Projects – Site Guide
- CIRIA SP156 - Control of water pollution from construction sites - guide to good practice, (2002)
- CIRIA Handbook C692 Environmental Good Practice on Site
- CIRIA Handbook C651 environmental good Practice on Site Checklist
- The Environment Agency's approach to groundwater protection (version 1.2 February 2018)

[1] https://flood-map-for-planning.service.gov.uk/

6.4. Local Guidance

- Sustainable Drainage Systems (SuDS) a Local Design Guide, Appendix A to the Suffolk Flood Risk Management Strategy, Suffolk Flood Risk Management Partnership, May 2018
- Suffolk SuDS Palette (SPP) – Guidance, Suffolk County Council

6.5. Design Manual for Roads & Bridges

- Design Manual for Roads & Bridges (DMRB): *CD 529 Design of outfall and culvert details*
- DMRB: CD 522 Drainage of runoff from natural catchments

6.6. Environment Agency Guidance Notes[2]

- Pollution Prevention Guidelines (PPG)1 General Guide to the Prevention of Water Pollution
- PPG3 Use and Design of Oil Separators in Surface Water Systems
- PPG4 Disposal of Sewage where no Mains Drainage is Available
- PPG5 Works in, or liable to affect Watercourses
- PPG6 – Working at construction and demolition sites;
- PPG8 – Storage and disposal of used oils;
- PPG20 – Dewatering of underground ducts and chambers;
- PPG21 – Pollution incident response planning;

6.7. Regulatory Position Statements

- Treating and using water that contains concrete and silt at construction sites: RPS 235, September 2020
- Temporary dewatering from excavations to surface water, April 2020

7. SUSTAINABLE DRAINAGE PRINCIPLES

42. The proposed surface water drainage scheme has been designed to meet the requirements of the National Planning Policy Framework and the Non-Statutory Technical Standards For Sustainable Drainage Systems (SuDS), specifically paragraphs S2[3] and S4[4] by limiting the post development off site run-off to the existing greenfield rate and providing sufficient on site attenuation for rainfall events up to the 1 in 100 year rainfall event, plus a 30% allowance for climate change over the lifetime of the development.

43. The surface water system to be used for the construction phase of the converter station will comprise Option 2 in the SCC Construction Surface Water Management Plan Template i.e. install, use and remove a temporary surface water drainage system and that for the operational phase will comprise Option 1 i.e. build, use and remediate a permanent surface water drainage system.

44. Whilst conventional drainage methods have often been used for draining substations, for this location an appropriately designed, constructed and maintained SuDS is considered to be more suitable, in line with local and national guidance. The installation of SuDS will mitigate many of the potential adverse effects on the environment that may be caused by uncontrolled storm water run-off from a new development. This will be achieved through a combination of the following:

- Reduced run-off rates, which reduces the risk of downstream flooding;
- Encouraging natural groundwater recharge (where appropriate) to minimise the impacts on aquifers and river base flows in the receiving catchment;

2 The Environment Agency no longer provides 'good practice' guidance in the form of PPG and these documents were withdrawn in December 2015. The Environment Agency will be reviewing the validity of the archived documents as part of the government 'smarter guidance' project. While this process is concluded, the archived PPG documents are found at: https://www.gov.uk/government/collections/pollution-prevention-guidance-ppg

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

4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event

- Reducing pollutant concentrations in storm water, to protect the quality of the receiving water body;
- Acting as a buffer for accidental spills by containing and preventing a direct discharge of high concentrations of contaminants to the receiving water body;
- Contributing to the enhanced amenity and aesthetic value of developed areas; and
- Providing additional habitats for wildlife and opportunities for biodiversity enhancement.

45. There are four key elements of the SuDS that have been considered in the planning and design of the converter station these are:

- Attenuation.
- Infiltration.
- Conveyance.
- Pollutant removal.

46. A brief description of each of these is provided below.

7.1. Attenuation

47. Attenuation storage controls the rate of runoff by limiting the peak flow from the development into the receiving watercourse or drainage system. This is typically achieved through the use of a temporary storage facility, with a restricted outlet. The attenuation will be sufficiently sized to detain the runoff for a given return period, but will then allow the water to discharge, at a controlled rate, back to the receiving watercourse, over an extended period. For the converter station the storage has been designed to accommodate runoff from a 1 in 100 year storm event plus a 40% additional allowance for climate change. These measures will significantly reduce any peak flow rate and limit the run-off to the equivalent of the pre-existing greenfield (undeveloped) runoff and, minimising the increased risk of flooding downstream of the discharge.

7.2. Infiltration

48. Infiltration refers to allowing or encouraging water to soak into the ground, through the natural hydrologic processes. This is normally the most desirable solution for disposal of surface water from rainfall as it does not create any additional runoff and contributes directly to the recharge of the underlying groundwater.

49. The ground investigation for the converter station compound, undertaken in May and June 2021, included percolation tests. This confirmed that the ground is comprised of a glacial till with a low permeability. This precludes the disposal of the surface water, or foul water, directly to ground, through the installation of soakaways, or other engineered infiltration systems. Correspondingly the drainage design for the site has been progressed based on the assumption that there will be no infiltration.

50. Further infiltration testing is proposed at the site of the proposed SuDS pond. This will be undertaken to the correct depth, will be in line with the requirements of BRE365 and will be undertaken over a sufficient length of time to either allow for completion of the tests or to categorically demonstrate failure (i.e. at least 6 hours). Given the testing undertaken to date and the ground condition observed at and around the location of the proposed pond it is not envisaged that this additional testing will identify the infiltration is a viable solution; however, if better percolation rates were identified the drainage design would be updated accordingly reducing the peak rates and volume of surface water discharge required.

7.3. Conveyance

51. Conveyance is the process of transferring surface runoff from one place to another to manage the flow and to link the various SuDS components together. Rainfall collected in impermeable areas such as the access roads, the transformer bunds or the building roof, will be carried via underground pipes within the drainage system to the various elements of the SuDS system to allow treatment and attenuation to take place. Similarly, perforated filter drains will collect water percolating through permeable areas and convey the same to the downstream SuDS facilities described later.

7.4. Pollutant Removal

52. Pollutants that may be present in any surface water, associated with the converter station stage, will either be removed or suitably treated prior to discharge, to ensure there is no wider adverse environmental impact. The approach adopted will identify and consider the source and types of pollutants that may occur in the surface and waste waters from the converter station and show how these will be managed to prevent pollution of the receiving watercourses.

53. In the operation phase surface water drainage is unlikely to contain elevated level of suspended solids, or other pollutants. It is however noted that surface water collected from within the transformer bunds, or other oil-filled plant, has the potential to be contaminated with oil. To manage this and also manage minor levels of pollution possible from any built development, the drainage design includes:

- Localised filter drains (where possible) and catch pits around the site to help control pollution at source.
- Oil interceptor (Class 1) with additional filtration (ACO Q-Ceptor or similar approved) for sediments and dissolved metals.
- An alarmed pollution control system which would be triggered in the event of a major release of oils, and which would shut off the link between the drainage system and the pond, allowing for the internal site system to be cleaned prior to re-engaging its outfall into the SuDS pond. A manual shut-off valve, or similar, will also be provided;
- SuDS pond including a permanently wetted pond with ecological planting to provide additional settlement, filtration and treatment of flows prior to discharge from the site.

54. During construction, additional silt and other pollution control measures will be in place on site, prior to the SuDS facilities being completed, in compliance with the requirements set out in the Code of Construction Practice (CoCP) (Document EA3-GRD-CON-PLN-IBR-000110). The details of the control measures adopted will then be included and confirmed in in the Principal Contractor's Surface Water Management Plan, which will be reviewed and approved before work commences.

8. SURFACE WATER DRAINAGE STRATEGY

8.1. Introduction

55. The converter station is to be constructed on an area previously used as the temporary laydown area for the construction of the EA ONE Substation. This area is consequently covered in hardstanding (crushed rock, Type 1) and is drained via a system of shallow surface gullies and below ground drainage to a pond that was designed to discharge to the channel to the north that flows in an easterly direction.

56. Prior to commencement of the converter stage, this existing drainage network, which does not serve any off site areas and is now redundant, will be removed and replaced with a new drainage system consisting of a piped drainage with filter drains provided for gravel areas. This system has been designed such there will be:

- No surcharging of the drainage network for a storm with a 1 in 2 annual probability of occurrence and
- All flows will be retained below ground for all storm up to and including the 1 in 100 annual probability storm with a 40% uplift in peak rainfall depth to account for potential changes in rainfall severity associated with climate change.

57. Flows from this system will be drained to a new SuDS pond with discharge from this directed to the ditch immediately to the north at rates no greater than the median (QBAR) greenfield runoff rate. The pond is designed to hold excess flows above this rate for all storm up to and including the 1 in 100 annual probability storm with a 40% uplift in peak rainfall depth to account for potential changes in rainfall severity associated with climate change.

58. In the event of an exceedance event or system blockage, excess flows would drain away from critical infrastructure and would be routed towards one of the perimeter ditches which converge and drain away to the northeast. This mirrors the existing situation and does not pose a risk to any other existing or proposed infrastructure.

59. The design of the system is set out in more detail in the Principal Contractor's Drainage Strategy in Appendix 1.

8.2. Drainage from Temporary Laydown Area

60. The construction of the converter station will require the installation of a stone compound to the northeast of the converter station at Work No 65 to provide accommodation and welfare facilities for the Principal Contractor, storage of materials, plant and equipment. All drainage from this area will be temporary and will be the direct responsibility of the enabling contractor and all appropriate measures will be included to prevent any contamination of the surface water drainage from the compound. These requirements are defined in the CoCP (EA3-GRD-CON-PLN-IBR-000110) and will be further detailed in the Principal Contractor's environmental documentation.

61. The compound will be constructed with a surface comprising around 450mm of type 1 subbase graded to drain from west to east. Filter drains will be installed to receive runoff from this area and convey flows to a new swale which will be constructed around the southern and eastern boundaries of the compound.

62. Discharge from the swale will be directed to the ditch immediately to the south with rates restricted to the greenfield rate calculated for the equivalent storm. The swale is designed to hold excess flows above this for all storm up to and including the 1 in 10 annual probability storm.

63. The layout of the compound will be planned to site potentially polluting storage or activities, such as fuel storage and refuelling, away from the drainage systems and also existing ditches. Any fuel storage and refuelling areas will be suitably protected to prevent discharge of oil contamination and all flows will be directed via a hydrocarbon filter prior to discharge from the compound into the swale.

64. All sewage will be contained and removed from site for disposal (see Section 9..2).

65. The filter drains will slow and help remove sediment and other pollutants (if present) from storm runoff. These will discharge via sediment traps and orifice plate into a ditch or swale which will provide further opportunity for the settlement of sediment. Sandbags or stop logs will also be available for deployment on this outlet from the site drainage system in case of emergency spillages. This will allow discharges to be held back in the unlikely event of a pollution spill of any kind to allow for treatment and / or removal from the site by tankers.

8.3. Existing Drainage Networks

66. Existing land drainage systems will be maintained during construction, where possible, and if disturbance is necessary, reinstated on completion. Consultation with landowners and occupiers will be undertaken to establish existing drainage arrangements, location of drains and any other relevant information.

67. Further mitigation will include the use of a specialist, drainage contractor to undertake surveys to locate drains and create drawings both pre- and post-construction, and ensure appropriate reinstatement. Where drains are shallower than 1.5m, temporary damming, culverting or diverting may be employed, with agreement from internal drainage boards and flood management agencies.

68. The ditch to the north of the converter station compound which flows from west to east will be realigned slightly to the north of its existing route, with a channel profile mirroring the existing channel up and downstream of the realigned section. This ditch will be culverted to allow the construction of the access track to the temporary laydown area (see Watercourse Crossing Method Statement ()EA3-OND-CNS-REP-IBR-00005).

69. The ditch that runs from south to north to the east of the site will also be retained and a new section of drain will be created along (and outside of) the southern site boundary to intercept surface runoff and allow it to flow into this channel without flowing across the site.

8.4. Drainage from Converter Station Construction

70. When ground works commence, any potential for silt laden runoff will be identified and suitable pollution control measures put in place to ensure all discharges are considered to be uncontaminated. All necessary permits will be obtained by the Principal Contactor prior to commencement of these works. Any rainfall influenced runoff, after any appropriate pre-treatment on site (e.g. Siltbuster or similar water treatment units), will ultimately discharge through the SuDS facilities as these are to be installed at the outset of the construction phase. As stated earlier, the CoCP clearly states the requirements and the control measures to be used.

71. Additional measures and practices that will be incorporated comprise;

- Avoidance of excessive vehicle or plant tracking directly over topsoil stripped areas.
- Use of trackmat, or similar, where temporary off road access is required for excavator or other plant.
- Controlling and minimising runoff across the site, which otherwise might erode or impact on exposed soil and stockpiles, to carry suspended solids in the runoff.
- Construction of intercept ditches and silt fences as the first line of defence to protect areas vulnerable to erosion.
- Using best practice methodologies when working in or near water and when placing any concrete or grouting products.

8.5. Treatment of Cementitious Water

72. During the construction of the converter station, areas of concrete bases and equipment bunds will be constructed. With anticipated use and delivery of ready mix to site, cement polluted water will be generated from concrete washout, concreting operations and any cement grouting. The extent and location of the treatment facilities to be provided will depend on the frequency and volume of washout and the availability on site. The treatment provided will remove suspended solids in the effluent, using settlement basins, skips or proprietary treatment equipment (Silt buster or similar) and will include pH adjustment to an acceptable range. Treated water will be assessed for its suitability for discharge, along with other clean site runoff or for its reuse on site, in accordance with permit limits. Any accumulated solid cement wastes would be removed, in accordance with the Principal Contractor's waste duty of care and the requirements of the Site Waste Management Plan (included as Appendix 6 of the CoCP), if necessary, to an appropriately licenced facility for disposal.

73. Concrete and cement mixing and washing areas will be situated at least 10m away from the nearest ditch or watercourse. These will incorporate settlement and recirculation systems to allow water to be re-used. All washing out of equipment will be undertaken in a contained area, and unless separately agreed all water will be collected for off-site disposal.

74. Where a suitable sewer exists, and subject to an appropriate trade effluent consent from the sewerage undertaker, any excess water contaminated with cement would be treated and discharged to sewer. The treatment provided will remove suspended solids in the effluent, using lined settlement basins, enclosed skips or proprietary treatment equipment (Siltbuster® or similar) and will include pH adjustment to an acceptable range. In accordance with, Regulatory Position Statement 235, water that contains concrete will not be discharged to a watercourse or soakaway, even after treatment. If no suitable sewer exists such excess water would be tankered from the site for treatment and disposal at an appropriately licenced facility. Any accumulated solid cement wastes would be removed, in accordance with the Contractor's waste Duty of Care and the requirements of the Site Waste Management Plan (included as Appendix 6 of the CoCP), if necessary, to an appropriately licenced facility for disposal.

75. Dry mix concrete will not be laid in saturated conditions to minimise the potential for leaching of alkaline water. If required in saturated areas the excavation will be dewatered for a sufficient time to lay and set all concrete. Wet mix pouring will be subject to rigorous controls (shuttering, stand offs, bunding etc) to prevent discharge of cementitious material into drainage features and watercourses.

76. Cement bound sand (CBS) will be installed around the underground cable or cable ducts (if used) linking the Converter Station to the National Grid Substation. When water comes in contact with CBS, the pH can rise to pH 12 or greater because of the release of alkaline hydroxide (OH^-) ions and this water will therefore require treatment before discharge. This water will be treated (Siltbuster® or similar)on site before disposal or will be removed to an appropriately licenced offsite treatment facility.

77. Discharge of treated concrete wash water and treated water that has been in contact with CBS would require an Environmental Permit from the Environment Agency. If required this will be sought.

8.6. Main Access Road Surface Water

78. The main site access road was constructed as part of the EA ONE works. If required, during the construction phase, the main access road will have a portable wheel wash porter at the temporary access road (ca. 20 m from the bellmouth to East Anglia ONE access road),installed to prevent vehicles and plant to carry mud off site onto public roads. This would be a closed loop recycled facility so will not discharge and its use, operation and maintenance will be monitored on site. Contents would be disposed of via a licenced waste carrier.

79. Regular road sweeping during the construction phase shall prevent contamination of run-off from the adjacent highways and sediment from being washed into nearby watercourses.

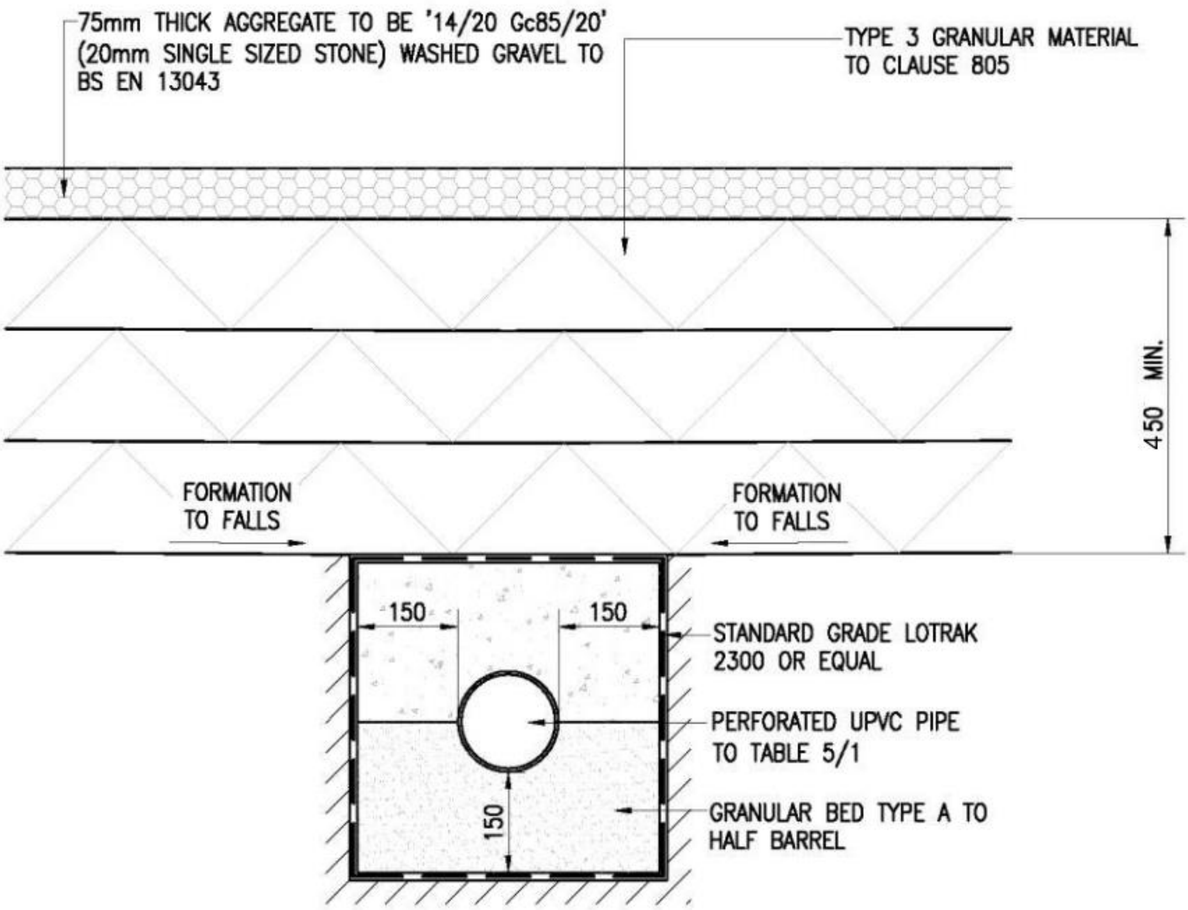
80. The drainage system associated with the main access road is already in situ. Surface water from the eastern section of the constructed main access road sheds to the south verge, running over the slab edge into a filter drain incorporating a perforated pipe at its base. The filter drain installed in the southern road verge provides a first stage of treatment and a degree of attenuation. The filter drain runs eastwards into the EA ONE SuDS detention basin 1 (Appendix 2), installed on the north side of the access road, adjacent to the site entrance. The SuDS basin provides a second stage of treatment and water from here is then pumped to the main EA ONE SUDs basin 3.

81. The western section of the main access road is drained in a similar manner, with surface water shedding toward the southern road edge with flow into a piped filter drain. The filter drain runs to the west, then north towards the converter station, diverting along the outer southern earthworks bund and into the EA ONE Wet Woodland SuDS facility, to the west of the Converter Station. This drain joins with the main drainage outlet from the converter station platform upstream of the SuDS area. Here again the filter drain provides the first stage of treatment and partial attenuation and the Wet Woodland provides the second stage of treatment and full attenuation.

8.7. Internal Service Roads and Converter Station Platform Run-off

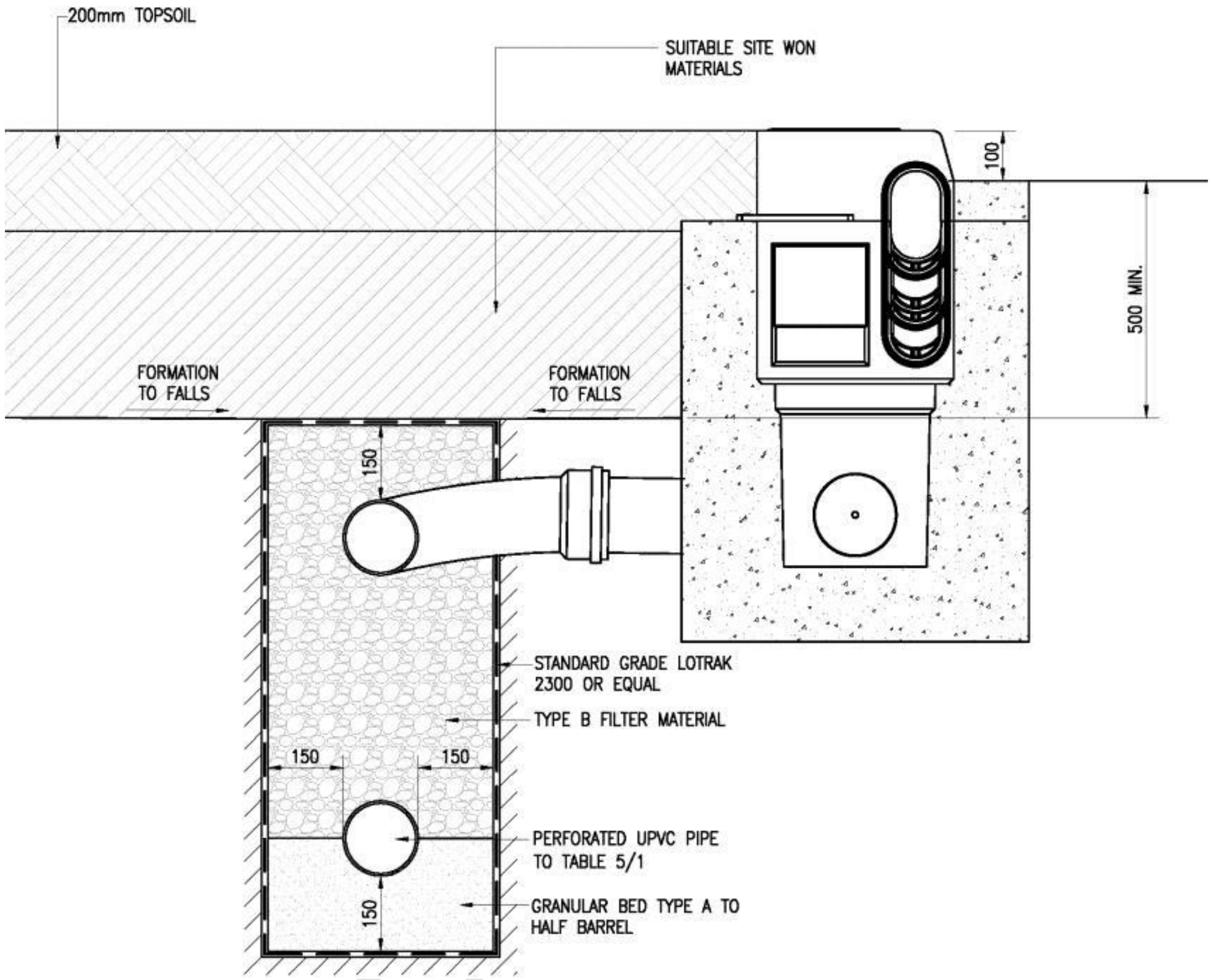
82. The level converter station platform will typically be constructed from suitably graded stone (Type 3) and surfaced in 20mm single sized stone chippings and is designed to be free-draining. A typical section of the construction is shown in Figure 4. The impermeable natural formation below the platform construction will be profiled to incorporate a sloping interface with construction above, with surface water collected in a system of perforated underdrains. The surface water percolating down through the granular material of the platform to formation level, will be provided with an initial stage of treatment and some attenuation, prior to its collection by the underdrains and conveyance in the drainage system to the SuDS pond located to the east of the converter station.

Figure 4 – Typical Converter Station Platform Make-Up



83. The surface runoff from the service roads and parking area will be collected via a kerb drainage system and discharged to a twin pipe filter drain (see Figure 5 and locations in Appendix 2) in the adjacent road verge, providing a first stage of treatment and a degree of attenuation. The filter drain will link with the converter station platform drainage network and run under the landscape embankments to the eastern boundary of the Converter Station. Outside the converter station platform, the pipe will discharge to the SuDS pond.

Figure 5–Indicative Kerb Drain and Twin Pipe Filter Trench



8.8. Buildings Surface Water

84. The uncontaminated surface water from the roofs of buildings within the converter station compound will be collected via a network of sub-surface drainage pipes and will join the drainage network, to outfall through the SuDS pond where, after combining with other surface drainage, it will receive appropriate attenuation and treatment prior to discharge.

8.9. Condensate Water from HVAC Filter Cooling System

85. The Converter Station HVAC system will produce a condensate water that will require discharge. The water will have a high purity and will be discharged to the surface water drainage system. The following quantities are anticipated:

- Summer max. approx. 50 l/day;
- Spring/Autumn approx. 15 l/day; and
- Winter approx. .3 l/d.

86. It is not appropriate to discharge this to the foul water drainage system due to its purity and volume.

8.10. Sustainable Drainage System Components

8.10.1. Platform Construction

87. The platform construction is described above (Section 8.7). The depth and grade of stone used to form the platform and surrounding permeable areas will provide an initial slowing and limited attenuation of rain fall as it filters through the stone to be collected in the perforated drains below to then run into the piped filter drains around the converter station. From here the water will flow to the SuDS pond, as described in Section 8.1. In smaller rainfall events, much of the surface water may be absorbed in the stone layers and evaporate, without reaching the underdrainage system.

8.10.2. SuDS Detention Pond

88. The SUDs pond proposed to the east of the converter station compound has been sized to receive and attenuate the drainage flows from up to a 1 in 100 annual probability storm plus an allowance for climate change of 40%.

89. The pond has been designed to include a small permanently wetted area to enhance biodiversity, to have shallow (1 in 3) side slopes and to allow access to the pond for maintenance through having one bank at a gradient of 1 in 5. The aquatic/pond planting shall be established before the SUDS drainage becomes operational. The vehicle access route to the pond will also be reinforced through the use of reinforced grass paving solution (turfstone pavers).

90. The volume of the pond has also been designed in excess of that solely required for hydraulic control of storm runoff. This additional volume provides a number of benefits including;

- capacity and freeboard to accommodate larger storm or blockage event;
- capacity for further holding back flows in the unlikely event of a major pollution event, and
- allowing the precise form of the pond to be adapted to maximise ecological and amenity benefits.

91. A Designers Risk Assessment has been included as Appendix 6.

8.11. Maintenance

92. The SuDS facilities will be included in a routine maintenance schedule carried out around the converter station, along with the landscape maintenance as described in the Converter Station Stage Landscape Management Plan (EA3-OND-CNS-REP-IBR-000002), to ensure they remain in effective operation. This will include checking of the various inlets and outfalls and the occasional cutting and removal of the vegetative growth on the inner slopes of the basins and any swales and appropriate maintenance of the vegetation within the SuDS pond.

93. The maintenance schedule for the various surface water features and proprietary devices is attached as Appendix 4.

8.12. Flood and Weather Alert

94. A Flood Plan has been prepared for the construction works and included as Appendix 2 of the CoCP (EA3-LDC-CNS-REP-IBR-000065). The Principal Contractor will sign up to the Environment Agency's flood warning system and Met Office severe weather warning system. The Flood Plan sets out the actions and responsibilities for three trigger levels and the all clear as shown in Table 8-1. The contact details of the person(s) responsible for each of these actions will be submitted to stakeholders for their records prior to commencement of construction.

Table 8-1 Met office Severe Weather Warning Levels

Warning Triggers	General Procedures	Specific Actions
Trigger Level 1	General actions include: • Communicate risk to all staff • Make sure you know who is on site • Take basic measures to prepare	• Place Staff on Green Alert • Check access and availability to, and condition of equipment: closed road signs, torches (check battery life/spares), high visibility jackets for all staff • Allow for handover should shift change occur before the warning is lowered

Warning Triggers	General Procedures	Specific Actions
	for flooding • Stay in a safe place with a means of escape. • Be ready should you need to evacuate.	• Check staff registers are complete and available to ensure all staff are accounted for post- evacuation • Speak to construction teams and request implementation of active measures to reduce the mobilisation fo sediment and other pollutants in storm water runoff. This is likley to take the form of bringing forward basic house keeping measures such a road sweeping and clearance of intercept ditches. • Reschedule (if reasonably possible and will not make situation worse) all engineering works which are liable to generate turbid runoff. This should include all earthworks. • Review active work programme and associated temporary drainage arrangements and confirm that these are all in place and functional. • Undertake survey of all active storm water drainage arranagments to check for damage, blockages or other problems which could impair their correct function and, in the event that defininciencies are identfied, action urgent remedial works.
Trigger Level 2	• Stay away from high risk areas • Turn off gas, electricity and water supplies if safe to do so. • Put flood protection equipment in place if safe to do so. • Cooperate with the emergency services. • Call 999 if you are in immediate danger. • Evacuate site in an orderly and controlled way.	• Stop active work on the site and communicate change in flood status to all staff. • If reasonably possible within a short timeframe (1hr) remove plant and equipment and relocate to elevated area that is away from potential flooding. • Place staff on Red Alert and begin evacuation of jointing bay compound/CCS (Trigger Fire Alarm) • Operate the emergency electrical shut off switches terminating the electricity supply and all power supplies to construction works sites/compounds, but only if safe to do so. • Direct staff toward the flood rendezvous location avoiding any areas that are flooded. • Take register to ensure all staff are accounted for. • Direct all staff to depart the area using the agreed flood evacuation route. • Contact the Emergency Services and EA to confirm that the work sites are being closed due to the risk of flooding

Warning Triggers	General Procedures	Specific Actions
Trigger Level 3	• Evacuate site as quickly as can be safely achieved. • Account for all personnel • Leave the area	• Immediately start evacuation of jointing bay compound and CCS if not actioned on receipt of the Flood Warning (Trigger Fire Alarm at compounds) • Direct staff toward the flood rendezvous location avoiding any areas that are flooded. • Take register to ensure all staff are accounted for. • Direct all staff to depart the area using the agreed flood evacuation route. • Contact the Emergency Services and EA to confirm that the work sites are being closed due to the risk of flooding
All Clear	• Be careful. Flood water may still be around for several days. • If you've been flooded, ring your insurance company as soon as possible.	Where the preceeding event related to rainfall or resulted in flood water entering or passing through the site storm water management systems, the Principal Contractor will: • Undertake a survey of all active storm water drainage arranagments to check for damage, blockages or other problems resulting from the storm / flood. • Remedial works should be urgently undertaken on deficient drainage equipment. • Signficiant pollution of any surface waterbody should be reported to the Environment Agency.

9. WASTE WATER DRAINAGE STRATEGY

9.1. Introduction

95. The waste waters produced by the converter station in its operational phase comprise the foul water from the welfare facilities in the converter station buildings and the water collecting in the sealed bunds around oil containing equipment, which has the potential to be contaminated by oil from the equipment. A sustainable approach has been adopted, which is considered appropriate for each type of waste water and so is in line with the overall drainage strategy.

96. Potential pollutants within the waste water will be removed or treated prior to discharge, to ensure there are no wider adverse environmental impacts, with the level of treatment being dependent on the level of pollutant risk. The treatment proposals for the different areas (identified on the Overall Drainage Layout in Appendix 2) of the converter station are presented in Table 9-1.

Table 9-1 Foul Water Treatment Solutions

Source of pollution	Level of potential pollution	Treatment
Transformer Bund*	Possible contamination of surface water collecting in the bund by leak or spillage of coolant oil	Discharge of water will be via an automatic pumping system which discriminates between oil and water. It continuously monitors the levels of rainwater and oil collecting in the bund. When a pre-set water level is reached the pump is activated. Only clean, oil-free water is removed and when the lower level is reached the pump turns off.

Source of pollution	Level of potential pollution	Treatment
		Should oil be detected the oily water will be pumped to a mobile tank for disposal off-site via a suitable waste facility. If considerable amount of oil is observed in the bund (respectively the sump), automatic pumping shall be blocked. Clean water will be discharged to the SuDS pond.
Transformer Bund*	Possible contamination of surface water collecting in the bund by leak or spillage of coolant oil	Treatment via Class 1 oil interceptor followed by discharge to the SuDS pond
Control Building	Domestic level foul water / sewage	No on-site treatment provided. Waste water stored within a sealed Cess Tank and periodically removed by tanker to off-site wastewater treatment facility

9.2. Welfare Facility Foul Water

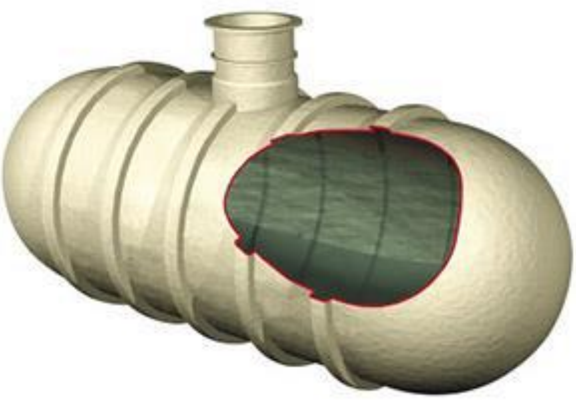
97. During construction, foul drainage (e.g. from construction welfare facilities) will be collected in a septic tank located within the laydown area and transported off site for disposal at a licensed facility.

98. The foul water from the welfare facilities within the buildings during the operational phase will be collected via a piped drainage system and conveyed to be held in a sealed cess tank. The location of the building drainage system and cess tank is shown on the Overall Drainage Layout in Appendix 2.

99. During normal operation of the converter station, there will be insufficient foul water discharged from the on-site welfare facilities to sustain the biological treatment processes within a normal small waste water treatment package plant (e.g. Biodisc Unit). Foul water from welfare facilities will instead be collected and conveyed to a sealed cess tank, of the type shown in Figure 6.

100. The cess tank will be designed to have sufficient storage capacity to contain the wastewater generated by the welfare facilities, for a minimum period of three months, sized to minimise the frequency of emptying required. The tank will have a capacity to accommodate a 20% factor of safety. The cess tank will also be fitted with a monitoring device and high level alarm system to alert maintenance staff to the need for emptying. The cess tank will be situated adjacent to the access road near the converter station entrance to provide ease of access for a tanker for the routine emptying of contents and their disposal to a suitably licenced waste water treatment and disposal facility.

Figure 6 - Sewage Cess Tank



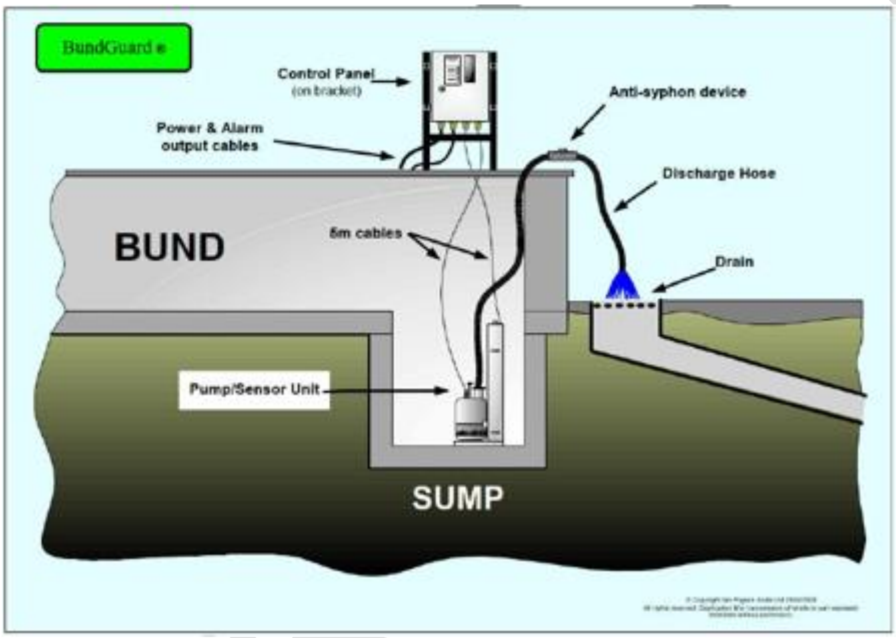
9.3. Surface Water from Equipment Bunds

101. Surface water collecting inside the bunds surrounding the transformers may come into contact with oil. This waste water cannot be treated in the same way as the foul drainage from the welfare facilities in the building. Any water contaminated with oil will be a hazardous waste and will be tankered off site for treatment at a suitable treatment facility.

102. The water in the bunds will be collected in a sump. Discharge of water will be via an automatic pumping system which discriminates between oil and water. The system will continuously monitor the levels of rainwater and oil collecting in the bund and sump. When a pre-set water level is reached the pump is activated (ie generally at a level to allow the pump to operate efficiently, which is dependent on pump manufacturer). Only clean, oil-free water is removed and when the lower water level is reached the pump will turn off. Should oil be detected the oily water will be pumped to a mobile tank for disposal off-site via a suitable treatment facility. If considerable amount of oil is observed in the bund (respectively the sump), automatic pumping shall be blocked.

103. Clean water from the transformer bunds/sumps will be conveyed via a class 1 oil interceptor and an ACO Q-Ceptor (or similar approved system) filter to the SuDS pond which will then provide further treatment and attenuation before discharging to the adjacent ditch.

Figure 7- Typical Oily Water Drainage Arrangement



9.4. Maintenance of Waste Water Facilities

104. The equipment provided to treat the foul and waste water from the converter station will be included in routine maintenance schedules to ensure they remain fully effective. This will include the routine emptying and maintenance of the cess tank to remove sewage from site and regular checks on the pumps, valves, sensors and alarms to ensure they are all functioning correctly. All maintenance activities shall also be recorded.

10. SUMMARY

105. This plan identifies the different elements of the surface and waste waters arising from the construction and operation of the EA THREE onshore Converter Station stage. In considering and outlining how these will be managed and controlled, it addresses the location of the development, the hydrology and hydrogeological setting and considers the ways in which the potential impacts of water from the Converter Station stage construction and operation will be minimised. The overall strategy adopted has been designed, therefore, to be able to ensure that, through the introduction and implementation of suitable control measures, there will be no measurable impacts on the receiving water catchment.

106. A drainage scheme has been developed, using a combination of conventional and sustainable drainage to handle the various waters. The uncontaminated waters from building roofs, hard standing including access roads and water percolating through permeable construction (platform) will be collected and routed to a SuDS pond. The pond is designed to provide attenuation and a controlled onward flow, holding the initial storm flush and then limiting the outfall discharge rate to that of the pre-existing green fields. This is designed to ensure there is no detrimental impact on the small receiving watercourses as a result of increased storm related flows from the development of the Converter Station and the introduction of an increased area of impermeable drainage.

107. Finally, the treatment and management of the waste waters are considered and outlined. Foul sewage will be contained in a sealed cess tank and tankered off site for disposal. Any oil containing equipment will be surrounded by an impermeable bund and any water drainage collecting inside the bunds that could become contaminated with oils, will only be discharged through the oil interceptors and filters installed to remove the risk of water contamination, in the event of any loss of oil.

108. Additional sensors, automatic and manual shutoff valves and alarms will also be added to the drainage equipment installed, to provide operators with a warning of any potential issues with pollution control equipment installed, to ensure they can take appropriate remedial action. All equipment and the SuDS elements will be included in routine maintenance to ensure they remain fully effective. All necessary permits will be obtained from the Environment Agency.

11. REFERENCES

CIRIA, 2001, *C532 Control of Water Pollution from Construction Sites*, London: CIRIA

CIRIA, 2002, *SP156 - Control of water pollution from construction sites - guide to good practice*

CIRIA, 2006, *C648 Control of Water Pollution from Linear Construction Projects – Technical Guidance*

CIRIA, 2006, *C649 Control of Water Pollution from Linear Construction Projects – Site Guide*

CIRIA, 2015, *C741D Environmental Good Practice on Site (fourth edition)*, London: CIRIA

CIRIA, 2015, *C753 SuDs Manual*, London: CIRIA

CIRIA, 2016, C762 Environmental Good Practice on Site pocket book (4th Edition), London: CIRIA

Council of the European Union, 2000, *The Water Framework Directive 2000/60/EC*. Available at: https://eur-lex.europa.eu/ [accessed 17/12/2020]

Council of the European Union, 2006, *The Groundwater Directive 2006/118/EC*. Available at: https://eur-lex.europa.eu/ [accessed 17/12/2020]

Council of the European Union, 2007, *The Floods Directive (2007/60/EC,* Available at: https://eur-lex.europa.eu/ [accessed 17/12/2020]

Department for Environment, Food and Rural Affairs, 2015, Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems

Environment Agency, 2001, *Pollution Prevention Guidelines 1: General Guide to the Prevention of Water Pollution (withdrawn),* Bristol, Environment Agency.

Environment Agency, 2006a, *Pollution Prevention Guidelines 3: Use and Design of Oil Separators in Surface Water Systems (withdrawn),* Available at: https://www.gov.uk/government/publications/choosing-and-using-oil-separators-ppg3-prevent-pollution [accessed 17/12/2020]

Environment Agency, 2006b, *Pollution Prevention Guidelines 4: Treatment and disposal of sewage where no foul sewer is available (withdrawn),* Available at: https://www.gov.uk/government/publications/sewage-treatment-and-disposal-where-there-is-no-foul-sewer-ppg4 [accessed 17/12/2020]

Environment Agency 2007, *Pollution Prevention Guidelines 5: Works in, or liable to affect Watercourses (withdrawn),* Available at: https://www.gov.uk/government/publications/works-in-near-or-over-watercourses-ppg5-prevent-pollution [accessed 17/12/2020]

Environment Agency, 2020, *Treating and using water that contains concrete and silt at construction sites RPS 235, Available at: https://www.gov.uk/government/publications/treating-and-using-water-that-contains-concrete-and-silt-at-construction-sites-rps-235 [accessed 17/12/2020]*

Environment Agency 2018a, updated 2020, *Temporary dewatering from excavations to surface water, Available at: https://www.gov.uk/government/publications/temporary-dewatering-from-excavations-to-surface-water [accessed 17/12/2020]*

Environment Agency, 2018b, *The Environment Agency's approach to groundwater protection (Version 1.2)*, Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/692989/Envirnment-Agency-approach-to-groundwater-protection.pdf [accessed 17/12/2020]

Highways England, 2020, *Design Manual for Roads and Bridges, CD 529 Design of outfall and culvert details (formerly HA 107/04), Revision 1, Available at: https://www.standardsforhighways.co.uk/prod/attachments/a7bfb30c-d084-4b28-b8d7-39dc4d14f5c0?inline=true [accessed 17/12/2020]*

Highways England, 2020, *Design Manual for Roads and Bridges, CD 522 Drainage of runoff from natural catchments (formerly HA 106/04), Revision 0, Available at: https://www.standardsforhighways.co.uk/prod/attachments/09c28187-371e-4180-8373-939f48607c01?inline=true [accessed 17/12/2020]*

Mid Suffolk District Council, 2008, *Strategic Flood Risk Assessment*. Available at: https://www.midsuffolk.gov.uk/assets/Strategic-Planning/Mid-Suffolk-SFRA/MidSuffolkSFRAFinal.pdf [accessed 17/12/2020]

Ministry of Housing, Communities and Local Government, *NPFF - National Planning Policy Framework,* 2021, Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2 [accessed 28/10/2021]

SEPA, 2009, *Engineering in the Water Environment Good Practice Guide Temporary Construction Methods*, March 2009

Structural Soils Ltd, July 2021, *EA THREE Substation Ground Investigation Factual Report on Ground Investigation* Report No: 735329 – 02 (00)

Suffolk County Council, 2018, *Suffolk Flood Risk Management Strategy, Appendix A: Sustainable Drainage Systems (SuDS) a Local Design Guide,* Available at: www.greensuffolk.org/assets/Greenest-County/Water--Coast/Suffolk-Flood-Partnership/2018-Strategy-Documents/2018-10-01-SFRMS-SuDS-Guidance-Appendix-A-.pdf [accessed 17/12/2020]

Suffolk County Council, undated, *Suffolk SuDS Palette (SPP) – Guidance*, Available at: https://www.suffolk.gov.uk/assets/Roads-and-transport/Flooding-and-drainage/Suffolk-Suds-Palette-002.pdf [accessed 17/12/2020]

Suffolk County Council, 2018, Template for Construction Surface Water Management Plans, August 2018 https://www.suffolk.gov.uk/roads-and-transport/flooding-and-drainage/guidance-on-development-and-flood-risk/construction-surface-water-management-plan/

The British Standards Institution, 2017, amended 2019, *BS 752:2017 Design of Drainage and Sewer Systems outside Buildings*, London, BSI.

The British Standards Institution, 2002, *BS EN 858-1:2002 Separator Systems for Light Liquids (e.g. Oil & Petrol),* London, BSI.

The British Standards Institution, 2000, *BS EN 12056-3:2000 Gravity Drainage Systems Inside Buildings,* London, BSI.

The Environment Act 1995 c.25. Available at: https://www.legislation.gov.uk/ukpga/1995/25/contents [accessed 17/12/2020]

The Environmental Permitting (England and Wales) Regulations 2016 (SI 2016/1154). Available at: https://www.legislation.gov.uk/uksi/2016/1154/contents/made [accessed 17/12/2020]

The Flood and Water Management Act 2010. Available at: https://www.legislation.gov.uk/ukpga/2010/29/contents [accessed 17/12/2020]

The Groundwater (England and Wales) Regulations 2009 (SI 2009/2902). Available at: https://www.legislation.gov.uk/uksi/2009/2902/contents/made [accessed 17/12/2020]

The Land Drainage Act 1991 c25. Available at: https://www.legislation.gov.uk/ukpga/1991/59/contents [accessed 17/12/2020]

The Land Drainage Act 1994 c. 59. Available at: https://www.legislation.gov.uk/ukpga/1994/25/contents [accessed 17/12/2020]

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (SI 2017/407). Available at: https://www.legislation.gov.uk/uksi/2017/407/contents/made [accessed 17/12/2020]

APPENDIX 1 DRAINAGE STRATEGY

Drainage Strategy

Onshore Converter Station

Revision	Date	Reason for Issue
1	21/10/2021	First Issue
2	19/11/2021	Updated to incorporate Customer Comments
3	09/12/2021	Updated to incorporate Customer Comments
4	27/01/2022	Updated to incorporate Customer Comments

Summary of Changes (latest revision only)

SIEMENS EA3

Drainage Strategy

JANUARY 2022

Incorporating

Siemens EA3

Drainage Strategy

Author	Gareth Jones
Checker	Craig Higgins
Approver	Martyn Griffiths
Report No	SIE-ARC-XX-050-RP-C-0001
Date	JANUARY 2022

Version control

Version	Date	Author	Changes
P01	22/10/2021	G Jones	First Issue
P02	19/11/2021	C.Higgins	Updated following client comment
P03	09/12/2021	C.Higgins	Updated follow client comment
P04	27/01/2022	C.Higgins	Updated for SPR Comments

CONTENTS

FIGURES

TABLES

1 Introduction

This report has been prepared by Arcadis Consulting (UK) Limited for Siemens in support of a Planning Application for Siemens EA3 substation. This Report outlines the Drainage Strategy for the site.

The mitigation and control is an arrangement to cater only for EA3 related construction and associated operations.

1.1 Description of Development

The EA3 Site is located at the Bullen Lane Substation within Bramford, to the west of Ipswich. The area of investigation is located to the north of the main substation and is adjacent to a secondary area of the substation located to the west. The site is located on both agricultural land and an area of ground previously in use as storage and car parking. The wider area mainly comprises agricultural land, and the topography is generally flat. The development is approximately 3.5km West of the A14, with access from Bullen Lane to the East. The total site area (shown in Figure 1) is approximately 14.86 hectare (148600 m^2), (which includes the EA3 substation site, site compound, the pond and landscaping areas) centred around National Grid Reference (NGR) 609723 246185. The EA3 substation site itself equates to approximately 3 hectares in size.

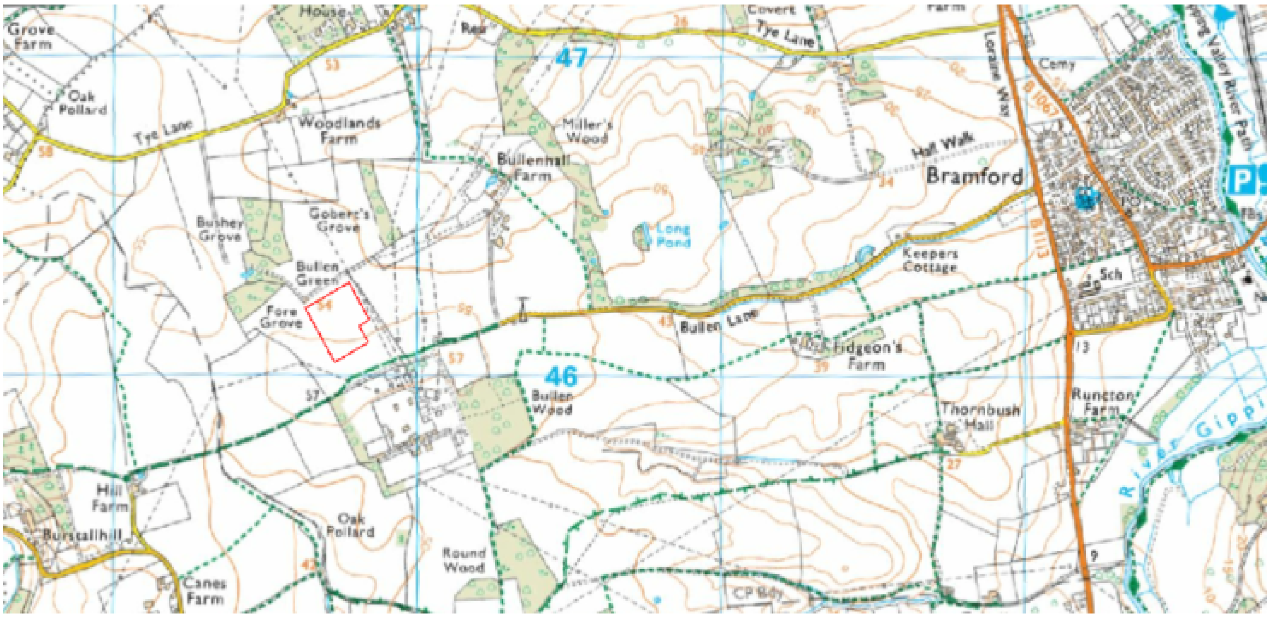


Figure 1 ; Site Location (Site Boundary outlined in Red)

2 Existing Site

2.1 Current Use and Site Topography

Site specific topographical survey information shows that the elevations within the whole site development area varies between 57.5m and 50m AOD and slopes in a south to north direction typically at a 1 in 75 grade, and west to east at approximately 1 in 85.

The site is classed as a brownfield site and is currently used as car parking and storage for the existing Substation (known as the EA1 Substation). An attenuation pond is located within the confines of the proposed site development, as indicated in Figure 2 below, which was used as a temporary storage facility during the construction of the EA1 substation. Prior to progression of the EA3 site design, it was noted that the pond will be infilled to accommodate the new development, the footprint of which covers the area of the temporary attenuation pond, and as such it has been deemed that there is no reliance on this pond for either site and no allowance has been made for the loss of this pond.

Stockpiled material from the EA1 substation is located to the south of the EA3 substation development area and will be removed prior to the commencement of construction for EA3.

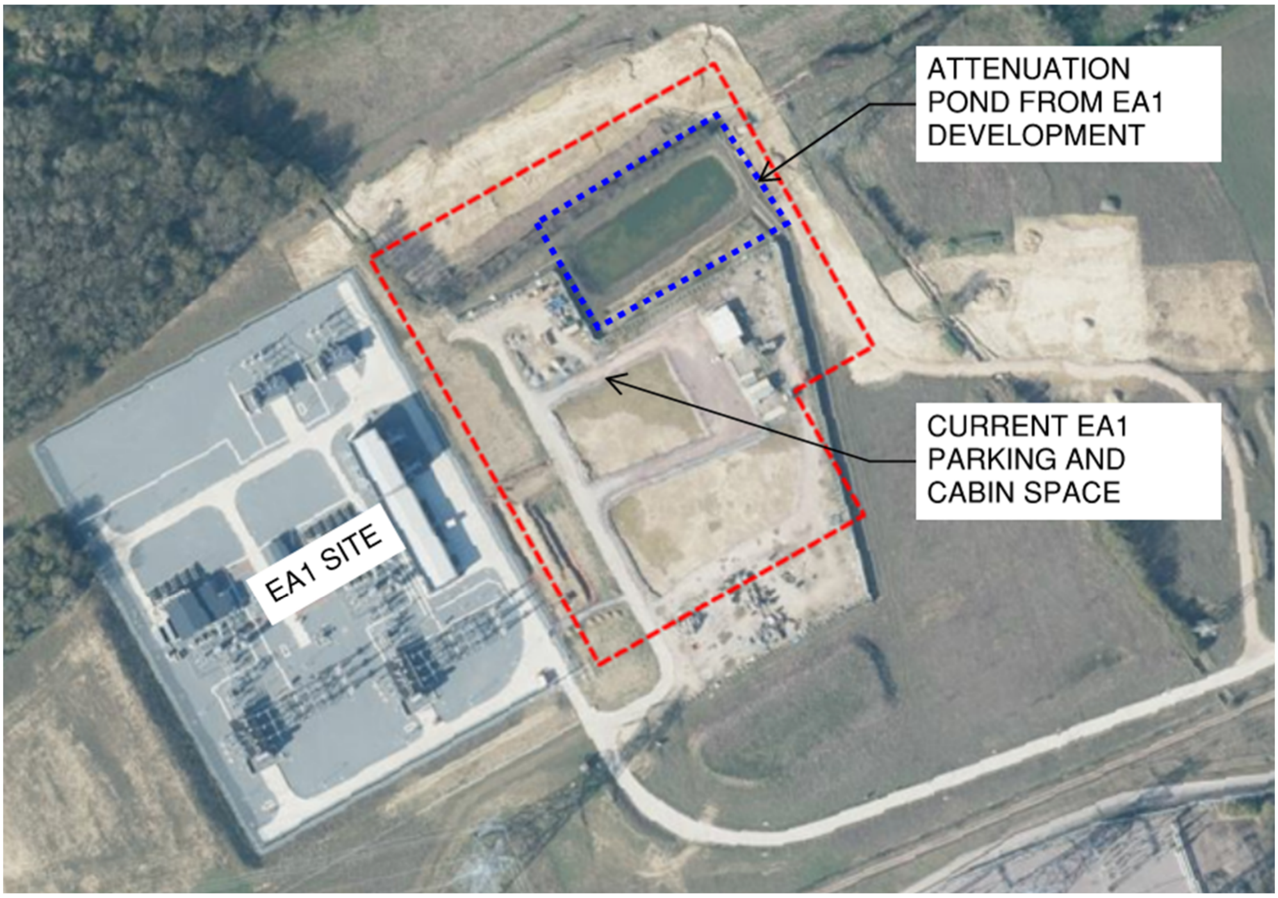


Figure 2: Existing Site Land Use (Site Boundary outlined in Red)

2.2 Existing Site Geology

Drift deposits mapping from the British Geology Society shows deposits of an extensive sheet of chalk till, with outwash sands, gravel, silts, and clays. Characterized by its chalk and flint content.

From an extract of the most recent available scanned map for the site within the British Geology Society report, it shows that the site is made up of Lowestoft Till, stony, sandy clay rich in chalk and flint pebbles.

A Geotechnical Investigation was undertaken by Structural Soil in July 2021 (Appendix E) and indicate within the borehole logs, that made ground is found at a depth of approximately 300mm across the site.

Soakaway testing was undertaken during the Geotechnical Investigation and the results presented indicate that infiltration within the site is not a feasible method of surface water discharge. Two number trials were undertaken, and the results indicate that the water levels over the testing period did not fall, and as such infiltration into the existing strata did not occur.

The testing procedure was undertaken to the BRE 365 infiltration testing method, however, the location and depth of these were not undertaken in the location required to confirm viability based on the updated design. Additional Site Investigation works are planned to be undertaken and further BRE 365 Soakaway tests to the location and depths required will be re-executed to confirm the infiltration capabilities as necessary to comply with the latest design. If the updated GI testing shows favourable infiltration rates, the design will be updated accordingly to accommodate infiltration as part of the design. Until such time that this data is available, it is assumed that infiltration is not a viable means of discharge, and the strategy at this stage is to discharge into surrounding land drainage ditches.

2.3 Local watercourse networks and drainage mechanisms

Water course ditches are located within the development site area and are indicated in Figure 3 below. Existing land drainage ditches, noted as existing in Figure 3, span the field margins to the north and east. The northern ditch falls with the natural grade of the land in a west to easterly direction. The existing field ditch as noted on the east of the field boundary falls in a south to north direction within the vegetated channel, assumed to connect into the northern exiting land drain.

The ditches noted as temporary were created as temporary solution for the EA1 substation compound, surrounding the temporary pond to the south, connecting into this pond, which in turn discharges into the existing land drainage ditch on the northern side. These ditches have been backfilled in preparation for the EA3 development with the pond due to be backfilled in due course.

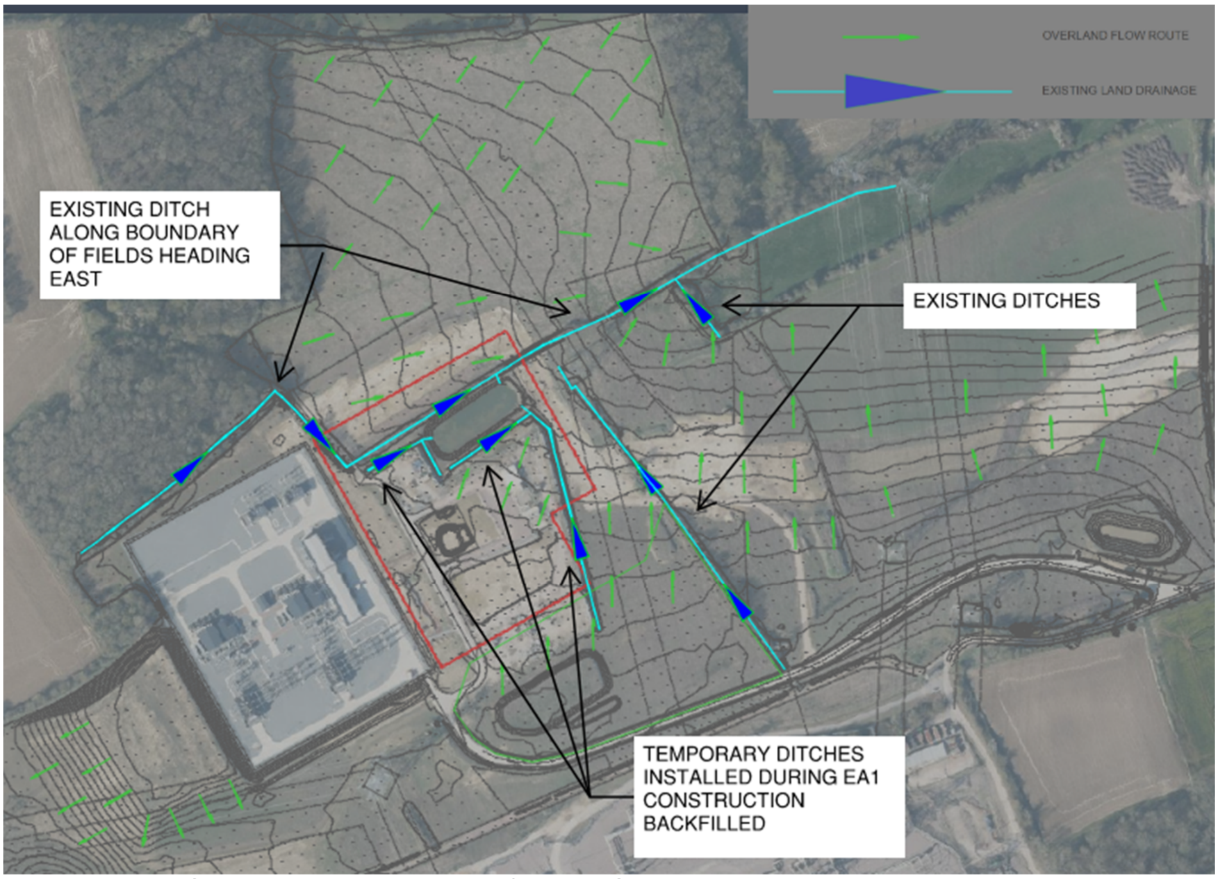


Figure 3: Existing Site Land Ditches and overland flow (EA3 Site Boundary outlined in Red)

As shown in Figure 3, the overland flow routing is directed away from the EA3 development site, falling towards the northeast. The routing of overland flow is directed towards land drainage ditches, which, as previously mentioned, direct runoff away from the site area to the east.

Rainfall on the developed areas of the site used for storage and car parking are of the following drainage mechanisms:

- Runoff onto the surround green space
- Runoff into man made drainage channels and ditches
- Evaporation and Transpiration – water evaporating from the surface of the ground

Rainfall onto the undeveloped sites areas is predominantly of a similar nature to the aforementioned with the addition of ground infiltration where possible.

Based on the information available, topography surveys and online mapping, it is assumed that the land drainage/ watercourse network continues its way to the east through a series of similar ordinary watercourse networks and out falling into the River Gipping as indicated below in Figure 4.

Figure 4: Location of River Gipping - Assumed land drainage outfall location

2.4 Existing Runoff Rates

Without appropriate control measures, the proposed development could increase the volume and rate of surface water runoff though the addition of impermeable surfaces such as pavements, footways and structures.

The greenfield runoff rates have been calculated using the ICP SuDS method (for a site with less than 50ha area) and the results are presented in Table 1. The calculations are based on a 1 ha area and the results are presented in Appendix A for further information.

Description	Rate (l/s/ha)
QBar Rural	2.7
Q1 Year	2.3
Q30 Years	6.5
Q100 Years	9.6

Table 1: ICP SuDS Greenfield runoff rates

To confirm the greenfield runoff rate the IH 124 determination method (sites at 50ha or greater) was used and calculated to its equivalent 1 ha area. The full results are also contained within Appendix A but are summarised below.

Description	Rate (l/s)/ 50 ha	Rate (l/s/ha)
QBar Rural	134.3	2.7
Q1 Year	116.9	2.3
Q30 Years	322.7	6.5
Q100 Years	478.2	9.6

Table 2: IH 124 Greenfield runoff rates

The calculated discharge rate for the site is 2.7l/s/ha. When considering the size of the EA3 development area, equating to 3ha, the allowable discharge rate into the existing land ditch will be limited to 8.1 l/s from this site. This ensures that the runoff captured, conveyed and discharged from the developed site will not increase the volume of runoff into the ditches but will limit it to existing runoff rates, ensuring no detriment to the existing land drainage ditches in terms of capacity requirements and no increase in volumetric runoff.

2.5 Flood Risk

The site is shown by the Environment Agency's online Flood Map for Planning (Rivers and Sea) to be located within Flood Zone 1, land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). An extract of the EA Flood Map for Planning (Rivers and Sea) is shown in Figure 5, below. The site is therefore confirmed as not being at risk of flooding from fluvial sources. The nearest location where a higher risk of fluvial flooding is indicated on the mapping is approximately 1500m west of the site, associated with running through Burstallhill.

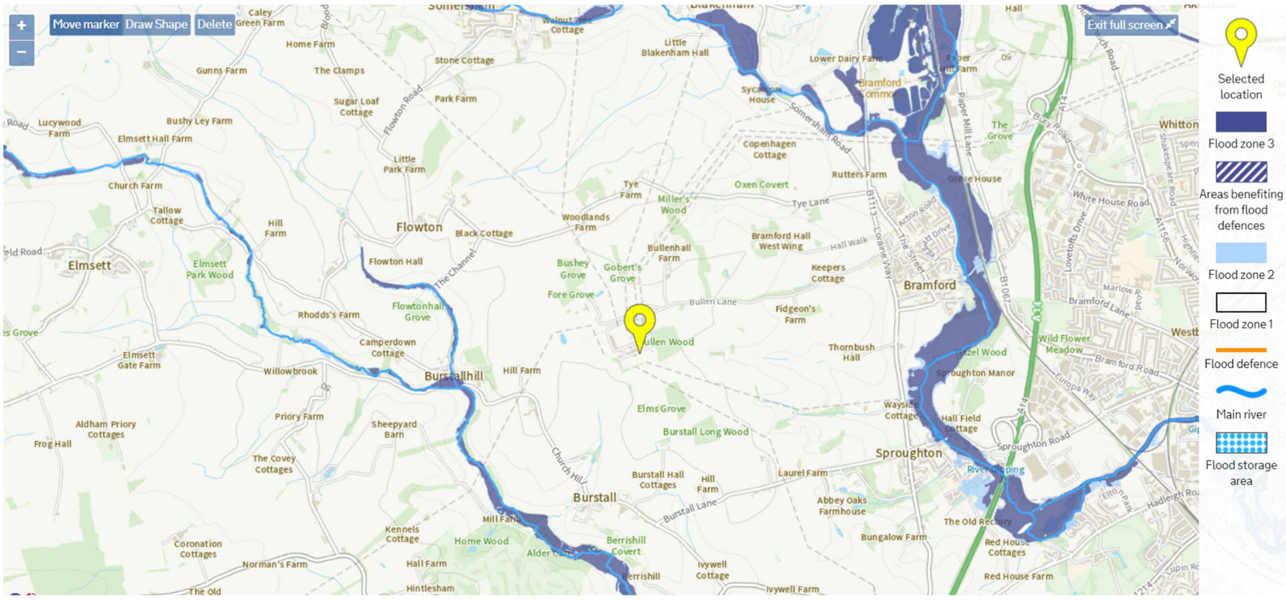


Figure 5: EA Flood map for Planning (Rivers and Sea)

The NPPF specifies that the suitability of all new development in relation to flood risk should be assessed by applying the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development proposed. As the site is shown to be located in Flood Zone 1, where the risk of fluvial flooding is lowest, the site can be considered appropriate on flood risk grounds, and the development proposals therefore pass the Sequential Test. The remainder of this report provides an assessment of flood risk from other potential sources of flooding, i.e., pertaining to the development, in line with the requirements of the NPPF.

3 Surface Water Drainage

3.1 Planning Policy Requirements and Suffolk Flood Risk Management Strategy

The National Planning Policy Framework (NPPF) specifies that surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development.

Planning Practice Guidance (Ref ID: 7-080-20150323) states that:

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as **reasonably practicable**:

1. into the ground (infiltration); [*Further testing to BRE 365 required – poor permeability calculated (refer to GI report in Appendix E and section 2.2*]
2. to a surface water body;
3. to a surface water sewer, highway drain, or another drainage system;
4. to a combined sewer;

Certain types of sustainable drainage systems may not be practicable in all locations.

The Suffolk County Council Local Flood Risk Management Strategy (SFRMS) sets out the overarching planning policy framework through which development will be planned and delivered across the County and defines how flood risk should be considered when planning any development in Suffolk County. The main requirements of this policy are in line with the requirements of the Planning Practice Guidance (PPG) and are summarised in the extracts below:

2.3 LPA Core Strategy Policies should therefore say something like: "Development will only be approved where it can be demonstrated that the proposal satisfies all the following criteria:

a. It does not increase the overall risk of all forms of flooding in the area through the layout and form of the development and appropriate application of Sustainable Drainage Systems (SuDS);

b. It will be adequately protected from flooding in accordance with adopted standards wherever practicable;

c. It is and will remain safe for people for the lifetime of the development; and

d. It includes water efficiency measures such as rainwater harvesting, or use of local land drainage water where practicable.

The Council will apply the following hierarchy for managing flood risk:

Assess: Strategic Flood Risk Assessment (SFRA produced by LPA) and site-specific Flood Risk Assessment (FRA) produced by developers.

Avoid: Layout should be designed so that the most vulnerable uses are restricted to higher ground at lower risk of flooding, with more flood-compatible development (parking, open space etc.) in the highest risk areas. Use Sustainable Drainage Systems (SuDS) at source.

Substitute: Apply the sequential approach to locate more vulnerable development in lowest risk areas.

Control: Use SuDS and implement Surface Water Management Plans (SWMP) to manage and reduce risk."

Figure 6: Extract from the Suffolk Flood Risk Management Strategy

The 'Substitute' Section of the policy, as shown in Figure 6, refers to the sequential and exception tests, the compulsory process which ensures that sites least at risk of flooding are selected for proposed developments. These tests are defined in the National Planning Policy Framework (NPPF) and associated Planning Practice Guidance on Flood Risk and Coastal Change. Additional guidance for their application within Suffolk County can be found in the Suffolk County Council Strategic Flood Risk Management Strategy (SFRMS).

As previously described in section 2.5, the site is within Flood Zone 1 and therefore not at risk of flooding from fluvial sources, hence passing this test as being allowable for construction.

The SFRMS also notes that it is a requirement for developments to provide a drainage strategy. The expectation for development to contain SuDS and ensure runoff rates are attenuated to greenfield runoff rates is also described.

Suffolk County Council SuDS Guidance

The Suffolk County Council FRMS Appendix A provides guidance on the County Councils requirements for the design of sustainable drainage systems on all major developments, and as the Lead Local Flood Authority (LLFA) they, the County Council, will make reference to this guidance when consulted upon.

The guide promotes and provides details for developments to utilise high quality SuDS principles that will not only provide suitable site drainage but also add benefit to the community and the environment. This guidance is utilised as the main driver for this drainage strategy.

A key summary presented in the guidance states: *"In summary Planning Practice Guidance Paragraph 50 states: Local authorities and developers should seek opportunities to reduce the overall level of flood risk in the area and beyond. This can be achieved, for instance, through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems, through safeguarding land for flood risk management, or where appropriate, through designing off-site works required to protect and support development in ways that benefit the area more generally.".*

The drainage strategy presented will provide a drainage design in compliance with this guidance, will ensure flooding of the area is not increased due to the development and will provide additional community benefits in the form of biodiversity and amenity improvements.

3.2 Drainage Principles

The drainage principles, in accordance with the SFRMS SuDS Guidance - Appendix C produced by Suffolk County Council and the CIRIA SuDS Manual, surface water and storm water should discharge to the following order of priority:

- Soakaway, or other adequate infiltration system
- Watercourse
- Existing Surface Water Sewer
- Existing Combined Sewer

Ground infiltration is normally the preferred method of discharging surface water runoff from a proposed development and should be used wherever feasible to mimic the existing diffuse discharge to ground.

However, due to poor infiltration noted during the GI testing period, and discussed in 2.2, infiltration will not be considered as a discharge method for this development.

As detailed in section 2.3 Local watercourse networks and drainage mechanisms, existing land drainage ditches are present around the development area and in compliance with the previously mentioned guidance and priority of discharge, the runoff from the site will be into the existing northern land drainage ditch.

Attenuation of runoff will be required, and this is proposed via an attenuation pond as discussed in the following sections.

3.3 Sustainable Drainage Systems

The proposed Surface Water Drainage Strategy layout utilising SuDS techniques is included in Appendix C. The drainage system has been designed to mimic a greenfield situation as closely as reasonably practicable, in line with best practice. The principles employed in this drainage strategy are to attenuate surface water to within the allowable rates, whilst providing measures to improve the quality of this runoff with the use of suitable SuDS source control techniques.

SuDS are water sensitive drainage systems which mimic natural catchment processes to manage urban runoff. A ‘treatment train’ of various SuDS is required to capture, detain, convey and discharge water from an urban environment. The treatment train concept is fundamental to designing a successful SuDS strategy.

The treatment train philosophy uses drainage techniques to systematically control the three elements of runoff and is required to capture, detain, convey and discharge water form an urban environment. The treatment train concept is fundamental to designing a successful SuDS strategy. This is achieved in three main steps: Source Control, Conveyance Control and Discharge Control (see Figure 7 below). Source control is preferred to those further down the train as they lead to the retention of pollutants and control of water before it enters the proposed or existing drainage network or watercourse. All of the methods suggested are recommended controls considered for SuDS and will be utilised where practical.

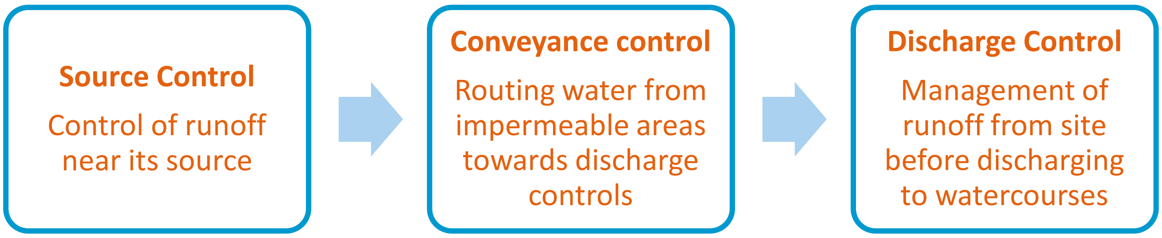


Figure 7: SuDS Treatment Train

Individual SuDS components are not treated in isolation but work together as a suite of drainage features. The SuDS components integrated into the proposed drainage system will reflect the desirability to have a mix of SuDS components across the site, as different components have different capacities for treatment of individual pollutants

This SuDS strategy and how it relates to the site is discussed further in section 4.1.8.

3.4 Storage Requirements

By using the Microdrainage software, an industry standard drainage design package developed by XP Solutions, the required attenuation storage volumes have been calculated in order to reduce the peak flow down to a greenfield runoff rate.

A quick storage estimate (Appendix D) shows that the site requires between 2167m^3 and 2565m^3 of storage, based on the 3Ha of EA3 substation development area. The proposed attenuation pond has approximately 3107m^3 of storage to cater for the 3Ha of development area along with the additional overland flow of 0.5ha from the surrounding area. Further detail is given in 4.1.6.

4 Proposed Drainage Strategy

4.1 Surface Water

The proposed drainage strategy drawings are shown in Appendix C. The design of the proposed surface water drainage network has been undertaken using the industry standard design software, Microdrainage, complying with the requirements as set out in the Suffolk County FRMS appendix C, SuDS guidance.

4.1.1 Design Guidance

The following design guidance will be adhered to for the proposed Surface Water Drainage System serving the proposed site:

- SuDS Manual, CIRIA C753.
- Building Regulations Part H
- National Planning Policy Framework (NPPF) & accompanying Planning Practice Guidance
- Sewers for Adoption (for adopted connections)
- BS EN 752:2008 Drainage & Sewer Systems Outside Buildings
- Suffolk County Council FRMS appendix C – SuDS Guidance

4.1.2 Key Design Principles

Specific Design Principles and criteria include:

- No increase in flood risk off site in all events up to the 100 year return period + 40% Climate Change allowance
- Provide adequate standards of flood protection on site
- No surcharge within the system in the 1 in 2 year event + 20% Climate Change allowance
- No flooding in the system in the 1 in 30 year event + 30% Climate Change allowance
- Flooding in the system temporarily stored within the highway or routed to open space or storage features – no flooding in buildings, or other areas for the 100 year + 40% CC return period.
- Designated flood paths/ storage areas permitted to flood at the 100 year return period
- Permitted discharge rates to green field runoff rate for QBar (1 in 100 year event)

4.1.3 Onsite EA3 Substation drainage

Management of the onsite EA3 substation drainage will be via a gravity drainage system, encapsulating the roof, road and hard standing area runoffs. Pipe sizes range from 150m diameter at the head of the run to 750mm diameter prior to the final outfall chamber S62.

The highway will be drainage via gullies and their associated connections.

The onsite drainage has been modelled using the FEH 2013 data for the 1 in 2 + 20%CC, 1 in 30 + 30%CC and 1 in 100 year + 40%CC allowance.

Results from the network indicate that, in the critical events:

- 1 in 2 year+20% CC – No surcharging occurs

- 1 in 30 year+30% CC – Surcharging in the networks occurs
- 1 in 100 year + 40% CC – Surcharging of the network occurs.

Due to the nature of the site being industrial and the requirements for a primarily concrete hardstanding and asphalt paved road to carry the structural loadings of the converter station structures, and to ensure any incidental pollution accidents are contained within the hard paved areas and not left to penetrate the natural strata and subsequent watercourse networks, SuDS has not been overly considered as a viable option for use within the area. However, a number of filter drains are proposed within gravel areas surrounding the Converter building Converter transformer area and switchyard. These will connect into the overall main drainage system.

The gravity network chambers will be of catchpits with an oil separator and containment system located upstream of outfall manhole S62. These two systems combined will ensure any oil spills or other contaminants are contained within the onsite networks.

In case of a major contaminant spill, the outfall chamber and oil separator will be electronically alarmed to warn of the incident and automatically closing off the network, preventing outfall into the attenuation pond off site. This will provide the required time to fully clean out the network prior to reopening for discharge into the attenuation pond.

Perimeter ditches

As previously mentioned in Section 2.3, local watercourse and drainage mechanisms, a number of temporary ditches were installed for the EA1 compound construction. These have been backfilled, with the temporary attenuation pond due to be backfilled in anticipation of the construction of the EA3 site. Figure 8 indicates the layout of the land drainage ditches post site completion.

To enable the construction of the EA3 site a perimeter ditch has been provided around the southern end of the substation site to intercept and convey runoff away from the development area into an existing local land drainage ditch. At the northern end, the existing ditch has been diverted to take it around the outside of the EA3 site. These are indicated below in Figure 8. The image indicates the diversion/ additional earth land drainage ditches and how they would tie into the existing network. Where the existing ditches are no longer required (blue line) they have been removed, giving an overall final picture of the proposed land drainage. Further detail is given in Appendix C.

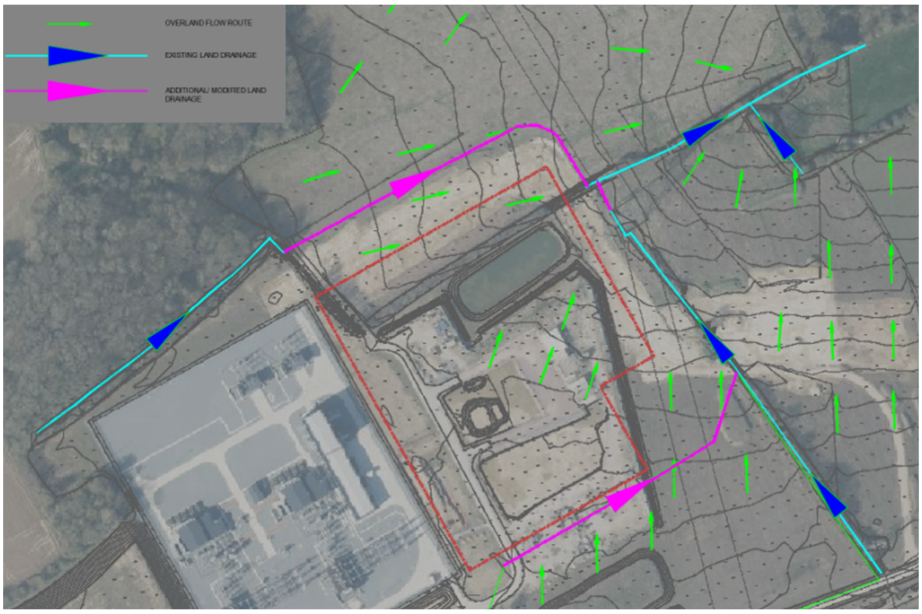
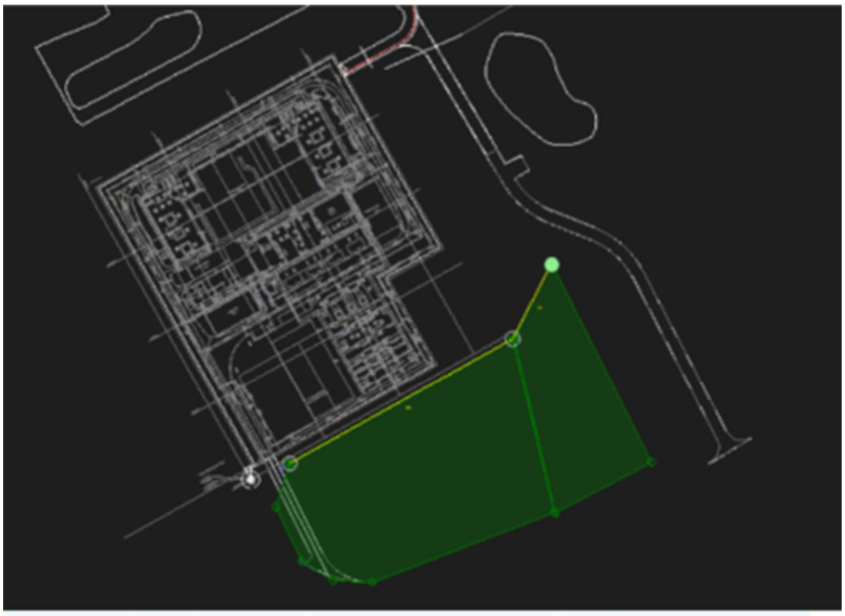


Figure 8: Perimeter ditches to EA3 Station

The earth ditch located to the north has been designed as a diversion to the existing with its geometry designed to correspond with, similar cross-sectional area, that which is already in place, to ensure the route is not throttled by a decrease in ditch size and to maintain the continuity of flow throughout. The depth of the ditch is approximately 700mm-800mm deep at the head of the diversion and increasing steadily in depth to approximately 1m where it ties into the existing. The ditch will not be receiving any additional runoff than it already does in its current form and therefore, no resizing is required due to the development.

The earth ditch located south of the EA3 site has been sized to correspond with the existing ditch sizes as are present in the area currently, typically 800mm deep along its length to capture and convey overland flow away from the EA3 station.

Preliminary calculations, undertaken on microdrainage, indicate that this ditch is sized appropriately to capture and convey runoff within its catchment area up to the 1in100y+40% storm event, ensuring that the EA3 substation area is protected from the runoff. Figure 9 below indicates the result outputs based on the current design.



Critical Summary of Results by Maximum Level (Rank 1)

Pipe Number	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Status
1.000	1	30 minute 100 year Winter I+40%	56.500	55.655	-0.598	0.000	0.11	OK
1.001	2	15 minute 100 year Winter I+40%	55.800	55.127	-0.626	0.000	0.09	OK

Figure 9: Southern land drainage cutoff ditch calculation results

Within the ditch design, it has been assumed that a percentage of impermeable area of 80% is apparent for a typically impervious geology. This will be confirmed during detailed design and the receipt of the updated geotechnical site investigation works. Additionally, the sizing of the ditches will be refined during detailed design to ensure optimised conditions, however, the preliminary design is adequate for its purposes in protecting the EA3 site.

4.1.4 Offsite Drainage and outfall

The offsite drainage has been designed to accommodate the flows from the main site area, store within an attenuation pond and discharge into the existing watercourse drainage network surrounding the site at greenfield runoff rate (8.1l/s) as indicated in Table 1..

Discharge from the site is via a 750mm diameter pipe, which in turn outfalls into the attenuation pond via a headwall. This arrangement can be seen in the drawings contained within Appendix C.

Discharge from the pond will be via headwall with a hydrobrake utilised to regulate and control the flows from the pond and the outfall pipe is proposed as 300mm in diameter. The relevant consents from Suffolk County

Council will be sought for out falling into the existing drainage ditch and these consents will be used to formulate the outfall detail.

The pond has been designed to accommodate a gentle slope towards the outfall headwall with sides slopes at 1 in 5 conforming with the FRMS and they requirements as set out by Suffolk County Council and to allow for a gradient that access for maintenance can be granted if and when required.

There is a section located near to the outfall headwall, deeper than the main pond bed to retain water in drier periods and enhance the biodiversity within the area.

4.1.5 Pond Access Road

The access road to the pond is indicated within the drawing packages in Appendix C and is located to the eastern side of the site.

The road is to be used initially as a temporary access during the construction of the EA3 substation but will be repurposed and utilised as access for pond and landscaping maintenance.

The end proposal for the route is to use a reinforced grass paving solution in the form of an interlocking cellular turfstone. An example of which is contained within Figure 10 below.

4.1.6 Attenuation Pond Storage

As previously noted in section 3.4 the pond storage volume as calculated equates to a value between 2167m^3 and 2565m^3 however, an increase in pond size has been provided to ensure the site plan area and the overland flow can be accommodated. Additionally, the pond has been increased in size for a number of additional benefits:

- Improve the sites aesthetics by breaking up the flat landscaped surrounding the site
- Making use of the available space within the planted area to improve the sites amenity, enhancing the provision of quality and attractive space aiming to promote health and well being benefits.
- Improving biodiversity – by adding an additional layer of habitat for the surrounding wildlife and nature, adding the planted areas around the site, creating a combined ecologically rich 'green and blue' corridor.

Table 5 shows the attenuation volume provided to contain the critical rainfall event for the 1 in 100-year rainfall event with an additional allowance of 40% for climate change. Full storage calculations can be found in Appendix D.

Positively Drained Area (ha)	Discharge Rate (l/s)	Storage Volume (m^3)
3Ha	8.1 l/s	3107

Table 3: Pond attenuation and discharge details

When designing the pond, this additional permanent storage depth was not considered and as such has been designed with a more conservative approach, i.e. the additional volume has not been taken into account.

Additionally, the volume of storage provided within the pond, 3107m^3, has been calculated using the lowest top of pond level of 50.610m, located immediately above the outfall headwall (and indicated on the drawings contained within Appendix C).

Details of the pond are contained within Appendix C and contains a GA and section through the pond.

The drainage design calculations contained within Appendix B, indicate the water levels within the pond at each of the return periods in the critical storm events. Table 4 presents the calculated data pertinent to the water levels with the pond at each critical storm event, highlighting the maximum water levels at each event and the depth of water (critical storm) above the resting water level within the permanent pond storage of 49.080m.

Storm Event (Critical) +CC	Water Level (Maximum) (m)	Depth of Water against resting water level 49.080m (outlet level) (m)
2 year +20%	49.425m	0.354
30 year + 20%	49.744m	0.664
100 year + 40%	49.952m	0.872

Table 4: Pond critical storm event - maximum water level and depth of water compared to the resting water level

Each of the scenarios above contain the water within the pond and the 100+40% water level maintains a minimum 600mm free board within the pond.

Figure 10: Turfstone interlocking paving example

4.1.7 Temporary works site compound drainage

The temporary works site compound is located to the northeast of the EA3 substation site as depicted in Figure 12 below. The site will be constructed based on a 300mm made ground strip and the placement and compaction of approximately 450mm of type 1 subbase. The compound area will be graded so as to ensure it falls in a west to east direction at a 1 in 100 slope.

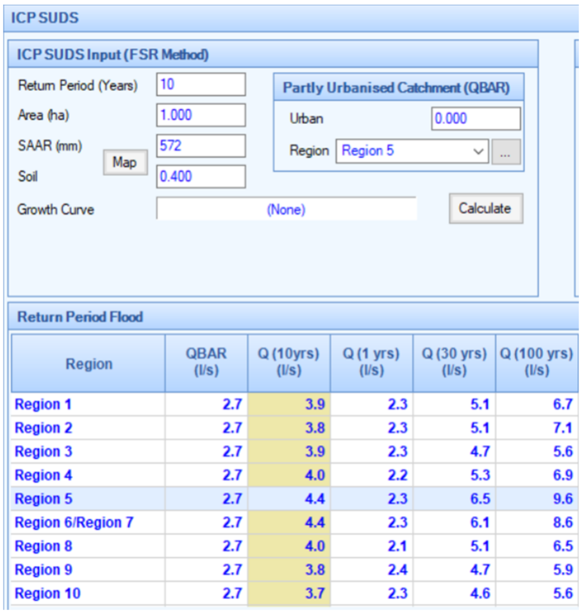
As depicted in the drawings contained within Appendix C, the area will be drained via a series of filter drainage laid at a depth of 1.2m at the head of each run, and graded to the outfall manhole located on the southeast corner of the compound at a depth of 2.1m. This is to ensure vehicular movements can occur within the compound are without the need for protective measures which would hinder the performance of the filter drainage. Additionally, it can be seen that a perimeter temporary ditch is located along the southern and eastern boundaries capturing and conveying runoff towards the southeast corner of the compound. The ditch and filter drainage networks will discharge into the existing ditch slightly to the east of the permanent pond outfall location.

Calculations for the filter drainage system and the perimeter ditches are contained within Appendix B. The calculations are based on designing for a 1 in 10 year storm event, limiting the discharge from the network to the corresponding to the 1 in 10 year storm events. As indicated in Figure 11, for a 1ha site the allowable discharge equates to 4.4l/s for the 1 in 10 year storm event. Taking into account the area of the construction compound equating to 1.7ha, the allowable discharge rate is calculated at 7.5l/s.

Within the calculations the runoff captured by both the filter drainage and the perimeter ditches have been split according to the type 1 material used to create the compound. Assuming that the type 1 is well compacted the following split has been assumed:

- 20% of the runoff will drain into the filter drainage
- 80% will outflow into the perimeter ditches.

To limit the discharge from the filter drainage, network a hydrobrake is proposed and from the perimeter ditch an orifice plate would be utilised.


ICP SUDS

ICP SUDS Input (FSR Method)

Return Period (Years): 10
Area (ha): 1.000
SAAR (mm): 572
Soil: 0.400
Growth Curve: (None)

Partly Urbanised Catchment (QBAR)
Urban: 0.000
Region: Region 5

Return Period Flood

Region	QBAR (l/s)	Q (10yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
Region 1	2.7	3.9	2.3	5.1	6.7
Region 2	2.7	3.8	2.3	5.1	7.1
Region 3	2.7	3.9	2.3	4.7	5.6
Region 4	2.7	4.0	2.2	5.3	6.9
Region 5	2.7	4.4	2.3	6.5	9.6
Region 6/Region 7	2.7	4.4	2.3	6.1	8.6
Region 8	2.7	4.0	2.1	5.1	6.5
Region 9	2.7	3.8	2.4	4.7	5.9
Region 10	2.7	3.7	2.3	4.6	5.6

Figure 11: Greenfield Runoff Rate 1 in 10 year event for a 1 ha site

Figure 12: Construction site compound location (blue) in relation to substation development area (red)

Oil and silt mitigation measures are included in the proposals and are included as details in Appendix C. The use of an oil removal cartridge (on the outfall pipe from the compound to the ditch) coincident with a catchpit chamber prevent silt and oil discharging into the ditch from the compound filter drains and gravel bags will be used prior to outfalling into the existing land ditch to further manage silt and solids. In addition, the use of silt fencing is proposed, bounding the perimeter of the existing ditch to prevent silt and debris from overland flow entering the ditch.

Any exceedance events not contained and managed by the filter drains and ditches would overflow from the ditch and make its way into the existing land drainage networks as typically would happen in its greenfield state. Due to the short time period required for the use of the construction compound and the inclusion of the mitigation measures, any impacts would be minimal with very limited consequences and as such is considered appropriate for the compound area.

The measures proposed for the site compound area are of a temporary nature and will be removed post construction completion and replaced to its original green field state.

As previously noted, the relevant consents and permissions will be obtained from Suffolk County Council prior to discharging into the existing watercourse ditch.

4.1.8 SuDS Treatment

As previously discussed in 3.3, the SuDS Treatment Train is a key concept that, wherever practicable, should be utilised for new development to mimic natural treatment of surface water runoff.

The drainage strategy for the EA3 site allows for the use of a treatment train but, due to the nature of the site, requires source control techniques that are more artificial than using a more natural approach.

Onsite, the use of catchpit chambers and interceptors along with alarmed shut off systems is used as the Source Control Function whereas offsite, the open greenspace and land earth drainage ditches provide the more natural Source Control features.

Similarly with Conveyance control, from within the EA3 development, due to the nature of the operational site, the use of piped systems is needed to conveyance surface water runoff. The use of SuDS is very limited within the area however, filter drains will be utilised in gravel areas bounding the compound building and areas providing a slight increase in SuDS benefit.

Offsite, Conveyance control will be in the form of natural overland routing and conveyance through earth land drainage ditches, giving the runoff a natural routing and treatment along its path.

Finally, the use of an attenuation pond provides the Discharge Control segment of the treatment train, managing the runoff from the EA3 site prior to out falling into the local watercourse network. The pond is designed to receive and store waters from the EA3 site and discharge at the required 8.1l/s greenfield runoff rate, ensuring no increase in discharge volume occurs in the receiving land drainage network, whilst storing water in the longer term for improved treatment, biodiversity and amenity in the area.

5 Levels of Service, Overland Flow Paths and Pollution Control

5.1 Levels of service

As required by the NPPF and the local Standards and Guidance for Surface Water Drainage, the surface water drainage systems will be designed to retain all runoff from rainfall events up to the 1 in 100 year rainfall events, with an additional 40% allowance for climate change. This is to prevent downstream flooding. Discharge controls in the form of a hydrobrake will be provided immediately upstream of the proposed points of connection to the receiving drainage ditch.

5.2 Overland Flow Paths

The drainage design and calculations (as shown in Appendix B and Appendix C) confirm that the network within the EA3 site area mitigate against flooding of the area and prevent the necessity for storage of flooding in the 100+40% CC event within the internal road network.

Additionally, the pond has been sized to capture and attenuate and discharge the surface water without flooding in the 100+40% CC return period, meaning no overland flow from the pond is expected. If, however, flooding did occur in the pond the fall of the land would ensure water is directed away from the Substation locations and towards existing ditches as indicated in Figure 3 and Figure 8, at the northern side of the development.

Overland flow is expected to fall towards the Substation area on its southern end, and an earth ditch is proposed to capture and convey runoff way from the site and into an existing ditch.

5.3 Pollution control

The onsite surface water drainage system will be designed, as noted in section 4.1.3, to mitigate against the risk of contaminants entering and penetrating the surround field areas and the local water course networks. A system of catchpit manholes oil interceptors/ separators will ensure any contaminant is captured and contained within the site and the addition of an alarmed pollution control system, which would come into effect in the case of an excessive recorded pollution incident, would cut the internal drainage system off from allowing discharge into the pond, allowing for the system to be cleaned prior to re-engaging its outfall into the attenuation pond.

The use of earth ditches and the pond itself will also contribute to the interception of runoff and provide a treatment of pollutants including sediment, heavy metals and oils.

Simple Index Approach

The Simple Index Approach as specified in the CIRIA SuDS Manual 2015, provides an indication on the performance potential for selected SuDS measures for the site. Based on this information the following results for the EA3 site are obtained:

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Notes

1 Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).

2 These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help determine the most appropriate approach to the development of a design solution.

Figure 13: Pollution hazard indices CIRIA SuDS Manual - selected appropriate indices

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters			
	Mitigation indices[1]		
Type of SuDS component	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Figure 14: SuDS mitigation indices CIRIA SuDS Manual - selected appropriate systems

From looking at the selected hazards and mitigation measures within Figure 13 and Figure 14, and using the formula of:

Total SuDS mitigation index = mitigation index$_1$ + 0.5(mitigation index$_2$) we can see that, as shown in Table 5, the total mitigation performs better that the total hazard, with the exception of the hydrocarbons section.

	Total Suspended Solids	Metals	Hydrocarbons
Hazard	0.8	0.8	0.9
Mitigation 3 Proprietary System – containment system	0.8**	0.8**	0.9**
Mitigation 4 Pond	0.7	0.7	0.5
Total mitigation	1.15	1.15	1.15

Table 5: Mitigation calculations for the EA3 site

The results presented in Figure 14 are based on a worst-case scenario for the site i.e. the sumped gullies and catchpit chambers along with the filter drains and gravel areas within the site, are negated from the calculations and the pollution containment system, with the calculation taking into account only the use of the Proprietary containment system and pond (Ref 4.1.3). the results indicate that these systems combined provide the required level of mitigation and are satisfactory for pollution control.

* Prior to entry into the Filter Drainage system, runoff will fall into large gravel areas acting as the initial treatment method against any solids, metals and hydrocarbons. Where runoff is captured within the gravity drainage system, gullies with sumps and catchpits chambers will provide traps for any detriment within the runoff. Where this does not provide enough or adequate mitigation, the surface water system passes through the containment system – oil separator complete with filter system for suspended solids and metals and per the ACO Q-Ceptor or similar approved and suitable filters.

**Within the site an oil containment system coincident with filter systems to cater for silt, suspended solids and metals will be used, as discussed in Section 4.1.3, to prevent oil their egress from exiting the site. The value of mitigation added for these systems isn't given in the tables provided for within the CIRIA guidance, however, the design of the containment system will be in accordance with the guidance set out in PPG 13 and t the British Water/ Environment agency standards to ensure the system performs in accordance with the relevant legislation.

The system therefore is deemed suitable for the site.

6 SuDS Maintenance

The maintenance of the SuDS features prescribed previously will utilise the maintenance regimes as specified in the CIRIA SuDS Manual, details of which are included below. Following completion of the detailed design of the site, a specific maintenance regime will be issued to the land owner, Scottish Power, by the designer.

Furthermore, maintenance of the site will remain with Scottish Power as landowner, as it is not proposed that any part of the site is adopted by the local authority.

6.1 Pond Maintenance

The following tables outline the maintenance requirements for the pond

TABLE 23.1 Operation and maintenance requirements for ponds and wetlands

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
	Check any mechanical devices, eg penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1 m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1 m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay.	Every 1–5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays.	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, eg every 25–50 years
Remedial actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair / rehabilitate inlets, outlets and overflows.	As required

Figure 15: Typical Pond Maintenance Schedule (CIRIA SuDS Manual C753)

6.2 Permeable paving

The following tables outline the maintenance requirements for the pond access paving

TABLE 20.15 Operation and maintenance requirements for pervious pavements

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Figure 16: Typical Permeable paving maintenance schdule (CIRIA SuDS Manual C753)

6.3 Land Ditches

Land Ditches would undergo a similar maintenance regimes as specified for a swale and as such an extract of this schedule is indicated below.

TABLE 17.1 Operation and maintenance requirements for swales

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Figure 17: Typical Maintenance schedule for ditches (CIRIA SuDS Manual C753)

7 Conclusion

This report has set out the principles for a viable drainage strategy for the disposal of surface water flows from the development in accordance with the Suffolk County Council Flood Risk Management Strategy and National guidance policies.

The key design principles are:

- Limiting surface water runoff from existing greenfield areas of the site to QBar runoff rates, and reducing runoff from existing paved areas as far as is reasonably practicable given the site constraints

- Use of sustainable drainage systems to manage and attenuate the increase in surface water runoff onsite, for up to and including the 1 in 100 year rainfall event (including an allowance for climate change)

- Pollution control measures will also be included to minimise the risk of contamination or pollution entering the receiving water body from surface water runoff from the development.

Through the use of a cellular pond access permeable paving system, attenuation pond and land drainage channels the proposed development will attenuate surface water flows, prevent flooding within the site and downstream, and provide water quality treatment. The proposed strategy therefore achieves the aims and objectives of both local and national planning policies.

Appendix A

Greenfield Runoff Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	1.000	Urban	0.000
SAAR (mm)	572	Region Number	Region 5

Results	**l/s**
QBAR Rural	2.7
QBAR Urban	2.7
Q100 years	9.6
Q1 year	2.3
Q30 years	6.5
Q100 years	9.6

IH 124 Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	50.000	Urban	0.000
SAAR (mm)	572	Region Number	Region 5

Results	**l/s**
QBAR Rural	134.3
QBAR Urban	134.3
Q100 years	478.2
Q1 year	116.9
Q2 years	120.0
Q5 years	173.3
Q10 years	222.3
Q20 years	280.8
Q25 years	303.8
Q30 years	322.7
Q50 years	381.7
Q100 years	478.2
Q200 years	562.8
Q250 years	589.7
Q1000 years	773.7

Appendix B

Drainage calculations

1 in 2 year + 20% Critical Event Calculations

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 611650 247100 TM 11650 47100
Data Type	Catchment
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	50.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	20, 20, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S63	15 Winter	2	+20%	100/15 Summer				53.566
S1.001	S64	15 Winter	2	+20%	30/15 Summer				53.458
S1.002	S65	15 Winter	2	+20%	100/15 Summer				53.448
S2.000	S4	15 Winter	2	+20%	100/15 Summer				53.548
S2.001	S5	15 Winter	2	+20%	100/15 Summer				53.530
S1.003	S66	15 Winter	2	+20%	100/15 Summer				53.427
S1.004	S67	15 Winter	2	+20%	100/15 Summer				53.396
S1.005	S68	15 Winter	2	+20%	100/15 Summer				53.362
S1.006	S69	15 Winter	2	+20%					53.329
S1.007	S70	15 Winter	2	+20%					53.288
S1.008	S71	15 Winter	2	+20%					53.232
S1.009	S72	15 Winter	2	+20%					53.183
S3.000	S13	15 Winter	2	+20%					53.530
S1.010	S73	15 Winter	2	+20%					53.112
S1.011	S74	15 Winter	2	+20%					53.011
S4.000	S26	15 Winter	2	+20%					53.505

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S63	-0.159	0.000	0.17		3.8	OK	
S1.001	S64	-0.130	0.000	0.17		3.5	OK	
S1.002	S65	-0.163	0.000	0.25		10.7	OK	
S2.000	S4	-0.102	0.000	0.18		1.3	OK	
S2.001	S5	-0.105	0.000	0.19		4.4	OK	
S1.003	S66	-0.138	0.000	0.40		15.9	OK	
S1.004	S67	-0.127	0.000	0.55		17.4	OK	
S1.005	S68	-0.208	0.000	0.34		18.7	OK	
S1.006	S69	-0.213	0.000	0.37		19.9	OK	
S1.007	S70	-0.301	0.000	0.19		22.8	OK	
S1.008	S71	-0.298	0.000	0.22		22.4	OK	
S1.009	S72	-0.309	0.000	0.18		23.0	OK	
S3.000	S13	-0.120	0.000	0.09		1.5	OK	
S1.010	S73	-0.314	0.000	0.20		24.0	OK	
S1.011	S74	-0.363	0.000	0.08		24.0	OK	
S4.000	S26	-0.170	0.000	0.13		3.2	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S4.001	S27	15 Winter	2	+20%					53.230
S4.002	S29	15 Winter	2	+20%					53.159
S4.003	S30	15 Winter	2	+20%					53.114
S4.004	S31	15 Winter	2	+20%					53.051
S4.005	S32	15 Winter	2	+20%					52.989
S4.006	S33	15 Winter	2	+20%					52.926
S4.007	S34	15 Winter	2	+20%					52.865
S1.012	S75	15 Winter	2	+20%					52.831
S5.000	S28	15 Winter	2	+20%	30/15 Summer				53.364
S5.001	S52	15 Winter	2	+20%	30/15 Summer				53.359
S5.002	S53	15 Winter	2	+20%	30/15 Summer				53.352
S5.003	S54	15 Winter	2	+20%	30/15 Summer				53.342
S5.004	S32	15 Winter	2	+20%	30/15 Summer				53.318
S5.005	S56	15 Winter	2	+20%	30/15 Summer				53.300
S5.006	S34	15 Winter	2	+20%	30/15 Summer				53.282
S5.007	S58	15 Winter	2	+20%	30/15 Summer				53.257
S5.008	S59	15 Winter	2	+20%	30/15 Winter				53.228
S5.009	S60	15 Winter	2	+20%	100/15 Summer				53.194
S5.010	S38	15 Winter	2	+20%	100/15 Summer				53.150
S6.000	S12	15 Winter	2	+20%	30/15 Summer				52.976
S6.001	S38	15 Winter	2	+20%	30/15 Summer				52.962
S6.002	S39	15 Winter	2	+20%	30/15 Summer				52.941
S6.003	S13	15 Winter	2	+20%	30/15 Winter				52.906
S6.004	S14	15 Winter	2	+20%	30/15 Winter				52.844
S5.011	S61	15 Winter	2	+20%	100/15 Winter				52.741
S7.000	S39	15 Winter	2	+20%	100/15 Summer				53.463
S7.001	S40	15 Winter	2	+20%					53.382
S7.002	S41	15 Winter	2	+20%	100/15 Winter				53.298
S7.003	S48	15 Winter	2	+20%	100/15 Winter				53.241
S7.004	S42	15 Winter	2	+20%	100/15 Summer				53.199
S8.000	S48	60 Winter	2	+20%					53.400
S7.005	S43	15 Winter	2	+20%	100/15 Summer				53.181
S5.012	S16	15 Winter	2	+20%					52.582
S1.013	S62	15 Winter	2	+20%					50.941
S1.014	S51	15 Winter	2	+20%					50.668
S1.015	S52	360 Winter	2	+20%	100/240 Summer				49.425
S1.016	S53	360 Winter	2	+20%	100/240 Summer				49.420

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S4.001	S27	-0.220	0.000	0.15		7.0	OK	
S4.002	S29	-0.214	0.000	0.15		6.8	OK	
S4.003	S30	-0.208	0.000	0.20		9.0	OK	
S4.004	S31	-0.277	0.000	0.13		10.6	OK	
S4.005	S32	-0.271	0.000	0.15		11.9	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S4.006	S33	-0.266	0.000	0.19		13.5	OK	
S4.007	S34	-0.285	0.000	0.10		13.3	OK	
S1.012	S75	-0.285	0.000	0.29		36.4	OK	
S5.000	S28	-0.186	0.000	0.10		4.1	OK	
S5.001	S52	-0.148	0.000	0.21		8.9	OK	
S5.002	S53	-0.123	0.000	0.34		10.7	OK	
S5.003	S54	-0.110	0.000	0.51		16.3	OK	
S5.004	S32	-0.103	0.000	0.53		16.0	OK	
S5.005	S56	-0.173	0.000	0.38		19.9	OK	
S5.006	S34	-0.168	0.000	0.40		22.7	OK	
S5.007	S58	-0.162	0.000	0.52		27.7	OK	
S5.008	S59	-0.167	0.000	0.56		29.4	OK	
S5.009	S60	-0.253	0.000	0.31		34.1	OK	
S5.010	S38	-0.254	0.000	0.39		36.6	OK	
S6.000	S12	-0.099	0.000	0.34		6.6	OK	
S6.001	S38	-0.147	0.000	0.34		10.6	OK	
S6.002	S39	-0.141	0.000	0.46		14.9	OK	
S6.003	S13	-0.221	0.000	0.32		22.5	OK	
S6.004	S14	-0.240	0.000	0.27		36.5	OK	
S5.011	S61	-0.304	0.000	0.49		74.3	OK	
S7.000	S39	-0.087	0.000	0.35		2.7	OK	
S7.001	S40	-0.153	0.000	0.21		4.6	OK	
S7.002	S41	-0.146	0.000	0.26		5.6	OK	
S7.003	S48	-0.145	0.000	0.25		5.4	OK	
S7.004	S42	-0.128	0.000	0.33		5.5	OK	
S8.000	S48	-0.150	0.000	0.00		0.0	OK	
S7.005	S43	-0.129	0.000	0.37		10.5	OK	
S5.012	S16	-0.592	0.000	0.10		85.4	OK	
S1.013	S62	-0.509	0.000	0.22		112.6	OK	
S1.014	S51	-0.582	0.000	0.11		112.8	OK	
S1.015	S52	-0.405	0.000	0.12		8.8	OK	
S1.016	S53	-0.410	0.000	0.01		8.1	OK	

1 in 30 year + 30% Critical Event Calculations

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 611650 247100 TM 11650 47100
Data Type	Catchment
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	50.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	20, 30, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S63	15 Winter	30	+30%	100/15 Summer				53.662
S1.001	S64	15 Winter	30	+30%	30/15 Summer				53.630
S1.002	S65	15 Summer	30	+30%	100/15 Summer				53.611
S2.000	S4	15 Winter	30	+30%	100/15 Summer				53.624
S2.001	S5	15 Winter	30	+30%	100/15 Summer				53.616
S1.003	S66	15 Summer	30	+30%	30/15 Summer				53.567
S1.004	S67	15 Winter	30	+30%	30/15 Winter				53.524
S1.005	S68	15 Winter	30	+30%	100/15 Summer				53.480
S1.006	S69	15 Winter	30	+30%					53.445
S1.007	S70	15 Winter	30	+30%					53.385
S1.008	S71	15 Winter	30	+30%					53.327
S1.009	S72	15 Winter	30	+30%					53.272
S3.000	S13	15 Winter	30	+30%					53.547
S1.010	S73	15 Winter	30	+30%					53.200
S1.011	S74	15 Winter	30	+30%					53.063
S4.000	S26	15 Winter	30	+30%					53.537

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S63	-0.063	0.000	0.38		8.4	OK	
S1.001	S64	0.042	0.000	0.59		12.5	SURCHARGED	
S1.002	S65	0.000	0.000	0.48		20.3	OK	
S2.000	S4	-0.026	0.000	0.42		3.0	OK	
S2.001	S5	-0.019	0.000	0.49		11.1	OK	
S1.003	S66	0.002	0.000	0.82		32.5	SURCHARGED	
S1.004	S67	0.001	0.000	1.31		41.4	SURCHARGED	
S1.005	S68	-0.090	0.000	0.83		45.0	OK	
S1.006	S69	-0.097	0.000	0.88		48.1	OK	
S1.007	S70	-0.204	0.000	0.45		55.8	OK	
S1.008	S71	-0.203	0.000	0.54		54.3	OK	
S1.009	S72	-0.220	0.000	0.45		56.3	OK	
S3.000	S13	-0.103	0.000	0.21		3.4	OK	
S1.010	S73	-0.226	0.000	0.49		59.8	OK	
S1.011	S74	-0.311	0.000	0.21		59.7	OK	
S4.000	S26	-0.138	0.000	0.32		7.6	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S4.001	S27	15 Winter	30	+30%					53.288
S4.002	S29	15 Winter	30	+30%					53.220
S4.003	S30	15 Winter	30	+30%					53.177
S4.004	S31	15 Winter	30	+30%					53.115
S4.005	S32	15 Winter	30	+30%					53.057
S4.006	S33	15 Winter	30	+30%					53.009
S4.007	S34	15 Winter	30	+30%					52.974
S1.012	S75	15 Winter	30	+30%					52.946
S5.000	S28	15 Winter	30	+30%	30/15 Summer				53.671
S5.001	S52	15 Winter	30	+30%	30/15 Summer				53.662
S5.002	S53	15 Winter	30	+30%	30/15 Summer				53.647
S5.003	S54	15 Winter	30	+30%	30/15 Summer				53.628
S5.004	S32	15 Winter	30	+30%	30/15 Summer				53.593
S5.005	S56	15 Winter	30	+30%	30/15 Summer				53.565
S5.006	S34	15 Winter	30	+30%	30/15 Summer				53.544
S5.007	S58	15 Winter	30	+30%	30/15 Summer				53.513
S5.008	S59	15 Winter	30	+30%	30/15 Summer				53.480
S5.009	S60	15 Winter	30	+30%	100/15 Summer				53.447
S5.010	S38	15 Winter	30	+30%	100/15 Summer				53.404
S6.000	S12	15 Winter	30	+30%	30/15 Summer				53.279
S6.001	S38	15 Winter	30	+30%	30/15 Summer				53.252
S6.002	S39	15 Winter	30	+30%	30/15 Summer				53.232
S6.003	S13	15 Winter	30	+30%	30/15 Summer				53.202
S6.004	S14	15 Winter	30	+30%	30/15 Summer				53.170
S5.011	S61	15 Winter	30	+30%	100/15 Winter				53.045
S7.000	S39	15 Winter	30	+30%	100/15 Summer				53.509
S7.001	S40	15 Winter	30	+30%					53.432
S7.002	S41	15 Winter	30	+30%	100/15 Winter				53.354
S7.003	S48	15 Winter	30	+30%	100/15 Winter				53.308
S7.004	S42	15 Winter	30	+30%	100/15 Summer				53.277
S8.000	S48	60 Winter	30	+30%					53.400
S7.005	S43	15 Winter	30	+30%	100/15 Summer				53.265
S5.012	S16	15 Winter	30	+30%					52.679
S1.013	S62	15 Winter	30	+30%					51.100
S1.014	S51	15 Winter	30	+30%					50.769
S1.015	S52	480 Winter	30	+30%	100/240 Summer				49.744
S1.016	S53	480 Winter	30	+30%	100/240 Summer				49.745

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S4.001	S27	-0.162	0.000	0.41		18.7	OK	
S4.002	S29	-0.153	0.000	0.40		17.6	OK	
S4.003	S30	-0.145	0.000	0.50		22.5	OK	
S4.004	S31	-0.213	0.000	0.33		26.0	OK	
S4.005	S32	-0.203	0.000	0.36		28.3	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S4.006	S33	-0.183	0.000	0.42		30.3	OK	
S4.007	S34	-0.176	0.000	0.22		28.6	OK	
S1.012	S75	-0.170	0.000	0.71		88.2	OK	
S5.000	S28	0.121	0.000	0.23		9.2	SURCHARGED	
S5.001	S52	0.155	0.000	0.58		24.5	SURCHARGED	
S5.002	S53	0.172	0.000	0.97		30.2	SURCHARGED	
S5.003	S54	0.176	0.000	1.49		47.4	SURCHARGED	
S5.004	S32	0.172	0.000	1.54		46.7	SURCHARGED	
S5.005	S56	0.092	0.000	1.13		58.4	SURCHARGED	
S5.006	S34	0.094	0.000	1.16		65.3	SURCHARGED	
S5.007	S58	0.094	0.000	1.50		79.8	SURCHARGED	
S5.008	S59	0.085	0.000	1.58		83.0	SURCHARGED	
S5.009	S60	0.000	0.000	0.86		93.4	OK	
S5.010	S38	0.000	0.000	1.02		95.1	OK	
S6.000	S12	0.204	0.000	0.73		14.2	SURCHARGED	
S6.001	S38	0.143	0.000	0.81		25.4	SURCHARGED	
S6.002	S39	0.150	0.000	1.11		35.7	SURCHARGED	
S6.003	S13	0.075	0.000	0.80		56.1	SURCHARGED	
S6.004	S14	0.086	0.000	0.67		89.0	SURCHARGED	
S5.011	S61	0.000	0.000	1.24		188.2	OK	
S7.000	S39	-0.041	0.000	0.83		6.3	OK	
S7.001	S40	-0.103	0.000	0.54		11.8	OK	
S7.002	S41	-0.090	0.000	0.64		13.6	OK	
S7.003	S48	-0.078	0.000	0.64		13.7	OK	
S7.004	S42	-0.050	0.000	0.86		14.5	OK	
S8.000	S48	-0.150	0.000	0.00		0.0	OK	
S7.005	S43	-0.045	0.000	0.97		27.6	OK	
S5.012	S16	-0.495	0.000	0.25		216.4	OK	
S1.013	S62	-0.350	0.000	0.54		276.2	OK	
S1.014	S51	-0.481	0.000	0.28		274.0	OK	
S1.015	S52	-0.086	0.000	0.26		18.9	OK	
S1.016	S53	-0.085	0.000	0.01		8.1	OK	

1 in 100 year + 40% Critical Event Calculations

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 611650 247100 TM 11650 47100
Data Type	Catchment
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	50.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	20, 20, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S63	15 Winter	100	+40%	100/15 Summer				53.816
S1.001	S64	15 Winter	100	+40%	30/15 Summer				53.771
S1.002	S65	15 Winter	100	+40%	100/15 Summer				53.748
S2.000	S4	15 Winter	100	+40%	100/15 Summer				53.792
S2.001	S5	15 Winter	100	+40%	100/15 Summer				53.783
S1.003	S66	15 Winter	100	+40%	100/15 Summer				53.707
S1.004	S67	15 Winter	100	+40%	100/15 Summer				53.637
S1.005	S68	15 Winter	100	+40%	100/15 Summer				53.576
S1.006	S69	15 Summer	100	+40%					53.542
S1.007	S70	15 Winter	100	+40%					53.447
S1.008	S71	15 Winter	100	+40%					53.387
S1.009	S72	15 Winter	100	+40%					53.329
S3.000	S13	15 Winter	100	+40%					53.555
S1.010	S73	15 Winter	100	+40%					53.255
S1.011	S74	15 Winter	100	+40%					53.091
S4.000	S26	15 Winter	100	+40%					53.554

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S63	0.091	0.000	0.50		11.1	SURCHARGED	
S1.001	S64	0.183	0.000	0.63		13.5	SURCHARGED	
S1.002	S65	0.137	0.000	0.81		34.0	SURCHARGED	
S2.000	S4	0.142	0.000	0.56		4.0	SURCHARGED	
S2.001	S5	0.148	0.000	0.58		13.1	SURCHARGED	
S1.003	S66	0.142	0.000	1.34		53.2	SURCHARGED	
S1.004	S67	0.114	0.000	1.88		59.5	SURCHARGED	
S1.005	S68	0.006	0.000	1.19		64.7	SURCHARGED	
S1.006	S69	0.000	0.000	1.18		64.1	OK	
S1.007	S70	-0.142	0.000	0.65		80.4	OK	
S1.008	S71	-0.143	0.000	0.78		78.0	OK	
S1.009	S72	-0.163	0.000	0.64		80.3	OK	
S3.000	S13	-0.095	0.000	0.28		4.7	OK	
S1.010	S73	-0.171	0.000	0.70		84.8	OK	
S1.011	S74	-0.283	0.000	0.30		84.8	OK	
S4.000	S26	-0.121	0.000	0.43		10.5	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S4.001	S27	15 Winter	100	+40%					53.318
S4.002	S29	15 Winter	100	+40%					53.253
S4.003	S30	15 Winter	100	+40%					53.211
S4.004	S31	15 Winter	100	+40%					53.152
S4.005	S32	15 Winter	100	+40%					53.121
S4.006	S33	15 Winter	100	+40%					53.090
S4.007	S34	15 Winter	100	+40%					53.062
S1.012	S75	15 Winter	100	+40%					53.013
S5.000	S28	15 Winter	100	+40%	30/15 Summer				53.950
S5.001	S52	15 Winter	100	+40%	30/15 Summer				53.937
S5.002	S53	15 Winter	100	+40%	30/15 Summer				53.912
S5.003	S54	15 Winter	100	+40%	30/15 Summer				53.881
S5.004	S32	15 Winter	100	+40%	30/15 Summer				53.810
S5.005	S56	15 Winter	100	+40%	30/15 Summer				53.749
S5.006	S34	15 Winter	100	+40%	30/15 Summer				53.714
S5.007	S58	15 Winter	100	+40%	30/15 Summer				53.662
S5.008	S59	15 Winter	100	+40%	30/15 Winter				53.576
S5.009	S60	15 Winter	100	+40%	100/15 Summer				53.479
S5.010	S38	15 Winter	100	+40%	100/15 Summer				53.413
S6.000	S12	15 Winter	100	+40%	30/15 Summer				53.514
S6.001	S38	15 Winter	100	+40%	30/15 Summer				53.471
S6.002	S39	15 Winter	100	+40%	30/15 Summer				53.440
S6.003	S13	15 Winter	100	+40%	30/15 Winter				53.391
S6.004	S14	15 Winter	100	+40%	30/15 Winter				53.340
S5.011	S61	15 Winter	100	+40%	100/15 Winter				53.046
S7.000	S39	15 Winter	100	+40%	100/15 Summer				53.586
S7.001	S40	15 Winter	100	+40%					53.489
S7.002	S41	15 Winter	100	+40%	100/15 Winter				53.448
S7.003	S48	15 Winter	100	+40%	100/15 Winter				53.408
S7.004	S42	15 Winter	100	+40%	100/15 Summer				53.378
S8.000	S48	60 Winter	100	+40%					53.400
S7.005	S43	15 Winter	100	+40%	100/15 Summer				53.368
S5.012	S16	15 Winter	100	+40%					52.752
S1.013	S62	15 Winter	100	+40%					51.220
S1.014	S51	15 Winter	100	+40%					50.827
S1.015	S52	480 Winter	100	+40%	100/240 Summer				49.952
S1.016	S53	960 Winter	100	+40%	100/240 Summer				50.103

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S4.001	S27	-0.132	0.000	0.56		25.6	OK	
S4.002	S29	-0.120	0.000	0.55		24.1	OK	
S4.003	S30	-0.111	0.000	0.68		30.8	OK	
S4.004	S31	-0.176	0.000	0.44		35.1	OK	
S4.005	S32	-0.139	0.000	0.47		37.5	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S4.006	S33	-0.102	0.000	0.54		39.1	OK	
S4.007	S34	-0.088	0.000	0.27		35.2	OK	
S1.012	S75	-0.103	0.000	0.95		118.8	OK	
S5.000	S28	0.400	0.000	0.31		12.5	SURCHARGED	
S5.001	S52	0.430	0.000	0.77		32.0	SURCHARGED	
S5.002	S53	0.437	0.000	1.26		39.2	SURCHARGED	
S5.003	S54	0.429	0.000	1.93		61.4	SURCHARGED	
S5.004	S32	0.389	0.000	2.05		62.1	SURCHARGED	
S5.005	S56	0.276	0.000	1.50		77.9	SURCHARGED	
S5.006	S34	0.264	0.000	1.61		90.4	SURCHARGED	
S5.007	S58	0.243	0.000	2.09		111.5	SURCHARGED	
S5.008	S59	0.181	0.000	2.26		118.8	SURCHARGED	
S5.009	S60	0.032	0.000	1.29		140.0	SURCHARGED	
S5.010	S38	0.009	0.000	1.64		152.7	SURCHARGED	
S6.000	S12	0.439	0.000	1.08		21.1	SURCHARGED	
S6.001	S38	0.362	0.000	1.17		36.8	SURCHARGED	
S6.002	S39	0.358	0.000	1.62		52.0	SURCHARGED	
S6.003	S13	0.264	0.000	1.15		80.1	SURCHARGED	
S6.004	S14	0.256	0.000	1.00		133.4	SURCHARGED	
S5.011	S61	0.001	0.000	1.96		298.9	SURCHARGED	
S7.000	S39	0.036	0.000	1.09		8.3	SURCHARGED	
S7.001	S40	-0.046	0.000	0.67		14.7	OK	
S7.002	S41	0.004	0.000	0.80		17.1	SURCHARGED	
S7.003	S48	0.022	0.000	0.82		17.6	SURCHARGED	
S7.004	S42	0.051	0.000	1.10		18.5	SURCHARGED	
S8.000	S48	-0.150	0.000	0.00		0.0	OK	
S7.005	S43	0.058	0.000	1.14		32.5	SURCHARGED	
S5.012	S16	-0.422	0.000	0.39		337.2	OK	
S1.013	S62	-0.230	0.000	0.76		392.7	OK	
S1.014	S51	-0.423	0.000	0.39		388.4	OK	
S1.015	S52	0.122	0.000	0.35		25.5	SURCHARGED	
S1.016	S53	0.273	0.000	0.01		8.1	SURCHARGED	

Southern End Drainage Cut Off Ditch

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 611650 247100 TM 11650 47100
Data Type	Catchment
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	100.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Winter	100	+40%					55.655
1.001	2	15 Winter	100	+40%					55.127

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.598	0.000	0.11		212.5	OK	
1.001	2	-0.626	0.000	0.09		334.8	OK	

Temporary Site Compound Drainage

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 611650 247100 TM 11650 47100
Data Type	Catchment
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm) 50.0 DVD Status ON
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	10
Climate Change (%)	0

PN	US/MH Name	US Label	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	1	FD	15 minute 10 year Winter I+0%	52.870	51.542	-0.128	0.000
1.001	2	FD	15 minute 10 year Winter I+0%	52.182	51.078	0.096	0.000
2.000	3	FD	15 minute 10 year Winter I+0%	52.497	51.271	0.039	0.000
2.001	5	FD	15 minute 10 year Winter I+0%	52.372	51.179	0.157	0.000
1.002	3	FD	15 minute 10 year Winter I+0%	51.724	50.879	0.754	0.000
3.000	3	FD	15 minute 10 year Winter I+0%	52.726	51.456	-0.120	0.000
3.001	4	FD	15 minute 10 year Winter I+0%	52.649	51.337	-0.112	0.000
4.000	7	FD	15 minute 10 year Winter I+0%	52.649	51.385	-0.064	0.000
4.001	8	FD	15 minute 10 year Winter I+0%	52.497	51.160	-0.072	0.000
4.002	9	FD	15 minute 10 year Winter I+0%	51.848	50.734	0.189	0.000
3.002	7	FD	240 minute 10 year Winter I+0%	51.866	50.487	0.443	0.000
1.003	4	FD	240 minute 10 year Winter I+0%	51.726	50.483	0.605	0.000
1.004	5	PIPE	480 minute 10 year Winter I+0%	51.726	50.478	0.663	0.000
5.000	15	EARTH DITCH	240 minute 10 year Winter I+0%	50.500	50.484	-0.560	0.000
5.001	3	EARTH DITCH	240 minute 10 year Winter I+0%	50.500	50.480	-0.375	0.000
6.000	16	EARTH DITCH	15 minute 10 year Winter I+0%	52.032	51.535	-1.268	0.000
6.001	5	EARTH DITCH	480 minute 10 year Winter I+0%	51.266	50.476	-0.611	0.000
1.005	16	DUMMY	480 minute 10 year Winter I+0%	50.500	50.476	0.926	0.000
1.006	20	DUMMY	480 minute 10 year Winter I+0%	50.500	50.477	0.927	0.000

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	0.05		0.6	OK
1.001	2	0.76		11.4	SURCHARGED
2.000	3	0.88		9.2	SURCHARGED
2.001	5	0.77		12.4	SURCHARGED
1.002	3	1.66		17.6	SURCHARGED
3.000	3	0.09		1.2	OK
3.001	4	0.14		3.0	OK
4.000	7	0.58		6.1	OK
4.001	8	0.50		7.9	OK
4.002	9	0.99		15.8	SURCHARGED
3.002	7	0.28		4.8	SURCHARGED
1.003	4	0.58		15.6	SURCHARGED
1.004	5	0.35		9.2	SURCHARGED
5.000	15	0.02		61.3	FLOOD RISK*
5.001	3	0.00		30.4	FLOOD RISK*
6.000	16	0.00		2.0	OK
6.001	5	0.00		0.6	OK
1.005	16	0.06		10.8	FLOOD RISK*
1.006	20	0.04		7.5	FLOOD RISK*

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	US Label	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.007	20	PIPE	1440 minute 10 year Winter I+0%	50.500	49.607	-0.314	0.000	0.02
7.000	8	FD	15 minute 10 year Winter I+0%	52.377	51.122	-0.105	0.000	0.19

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status
1.007	20		7.5	OK
7.000	8		4.7	OK

Appendix C

Drawings

EA3 Internal Drainage Layout

PROJECT NORTH
NORTH 29.450°

DRAWING LEGENDS

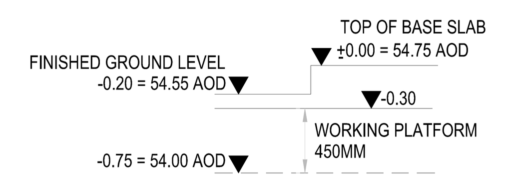
- SPOT LEVEL
- TP — TERMINAL POINT
- REFERENCE POINT
- SANITARY WATER DAINAGE SYSTEM
- MH — ROAD DRAINAGE SYSTEM
- FILTER DRAINS
- ROOF / SURFACE DRAINAGE SYSTEM
- ROAD GULLY
- BUILDING ROOFS
- ROADS & PARKINGS
- OILY WATER CONTAINMENT AREA (CONVERTER TREANSFORMER BUND)
- GLYCOL WATER CONTAIMENT AREA (CWC COOLERS BUND)
- ROADS/BUND/GROUND SLOPE DIRECTION
- ROOF SLOPE DIRECTION
- PIPE DRAINAGE FLOW DIRECTION
- RDP — RAINWATER DOWNPIPE
- PUMP WITH OIL DETECTION

NOTES:

1. ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
2. LEVELS

BUILDING FLOOR LEVEL	= ±0.000m	= +54.75m AOD
ROAD LEVEL	= -0.100m	= +54.65m AOD
FINISHED GROUND LEVEL	= -0.200m	= +54.55m AOD
WORKING PLATFORM LEVEL	= -0.750m	= +54.00m AOD

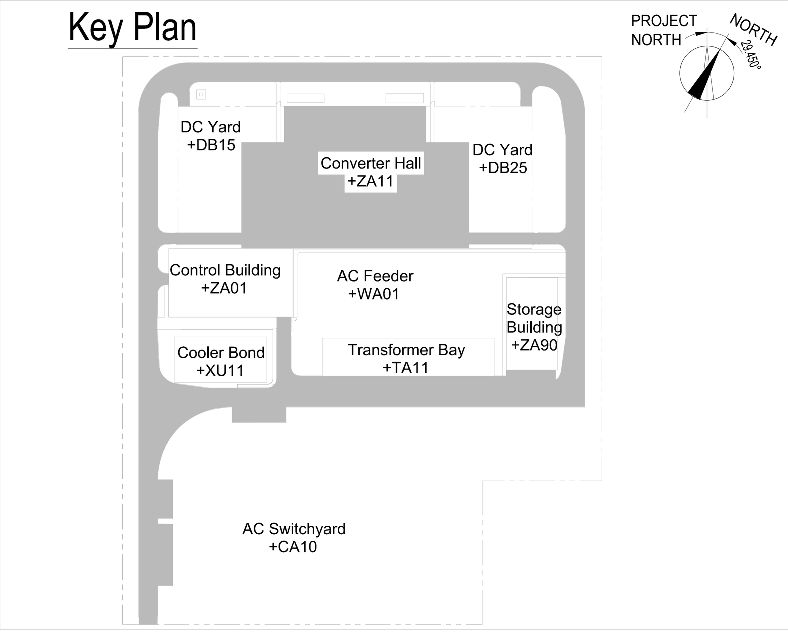
WORKING PLATFORM SECTION



IEC Identifier

#EA32	+DB15	DC YARD 1
#EA32	+DB25	DC YARD 2
#EA32	+RB01	AC FILTER
#EA32	+TA11	TRANSFORMER BAY
#EA32	+EQ11	CONVERTER WATER COOLING OUTDOOR AREA
#EA32	+ZA01	CONTROL BUILDING
#EA32	+ZA11	CONVERTER HALL
#EA32	+CA10	AC SWITCHYARD
#EA32	+ZA90	STORAGE BUILDING
#EA32	+ZC01	OUTDOOR FOUNDATION AREA
#EA32	+ZF01	AREA FOR DRIVEWAYS
#EA32	+ZF02	PARKING LOT

Key Plan



Scale:

0 2 5 10 25

1:250

IFA

IFA = Issued for approval
IFI = Issued for information
IFC = Issued for construction
IFIM = Issued for implementation (Design input)
IFM = Issued for manufacture
AB = As built (Documentation)

Project ID	Doc. Key: E	Aspect: C
Customer Document Number	EA3-OND-CIV-DRG-SAS-000017	
Plant Type / Voltage	HVDC Plus 1320 MW 320 kV DC / 400 kV AC	
Customer	East Anglia Three Ltd.	
Project	East Anglia Three	
Location(s)	East Anglia 3 - Onshore Station	
Scale	1:250	
Export Control Classification:	ECCN: N	AL: N
Responsible Dept.	GP EPC TS LTS	
Technical Reference	M. Schönhut	
Document Designation	32101# EA32	&CLD028-001
Paper Size	A0	
Sub-Contractor	SIEMENS energy	
Created By	Ravi Kumar	
Approved By	M. Schönhut	
Document Type	Planning Drawing	
Title, Supplementary Title	Dewatering Layout	
Document ID	E4A000000999057	
Rev.	02	
Release Date	2021-10-13	
Language	EN	
Page	1	

Rev.	Rev. Date	Revision Description	Drawn	Checked	Approved
02	2021-10-13	Second Issue	Ravi kumar	Vikash Jha	M. Schönhut
01	2021-09-02	First Issue	Ravi kumar	Vikash Jha	M. Schönhut

SCOTTISHPOWER RENEWABLES

ONCS EAST ANGLIA THREE

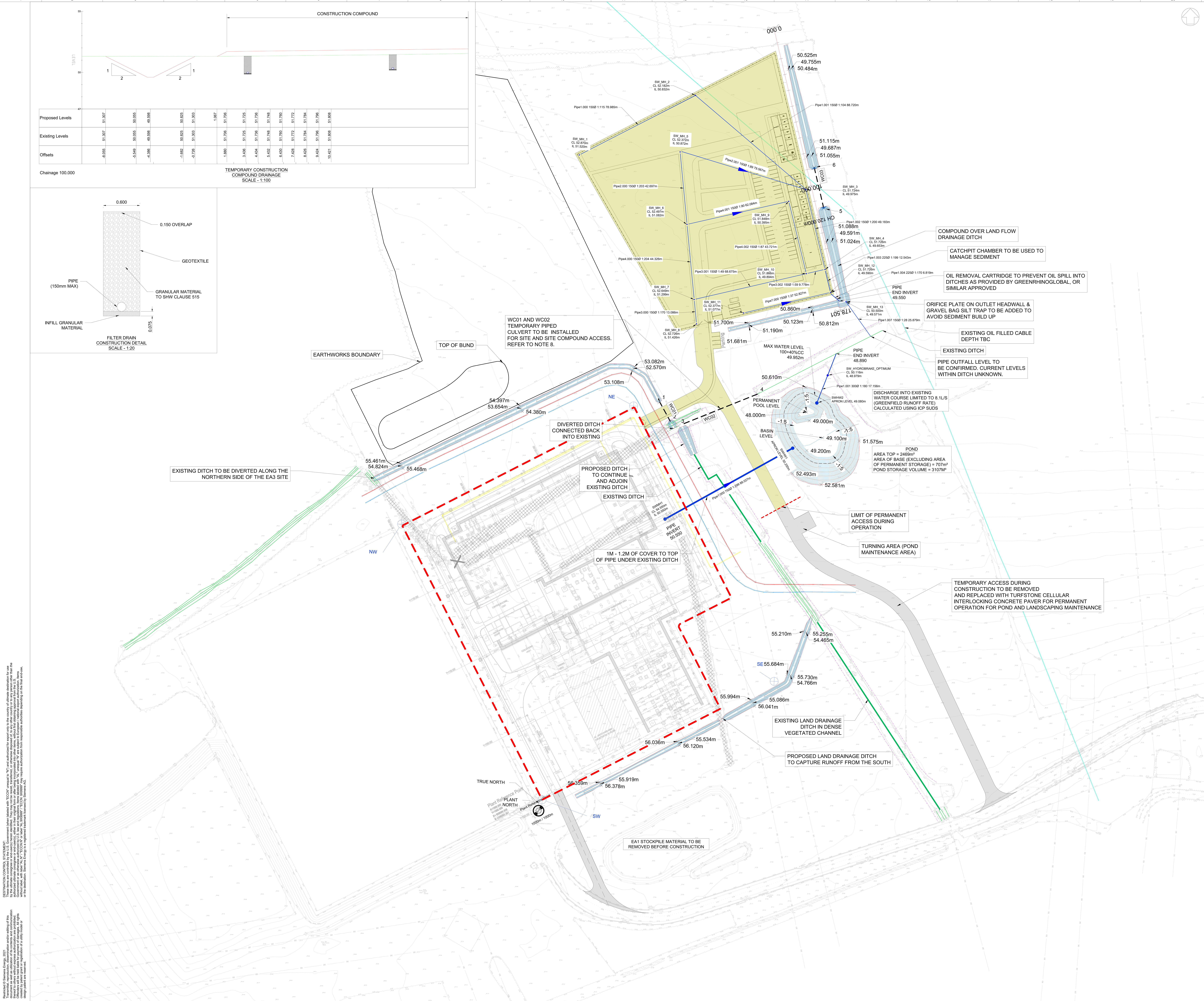
Drg Title

DEWATERING LAYOUT

Drg No: EA3-OND-CIV-DRG-SAS-000017

Size

SuDS Drainage Layout



NOTES

1. DO NOT SCALE FROM DRAWING USE FIGURED DIMENSIONS ONLY.
2. SITE AREA IS ASSUMED TO BE MADE GROUND SO NO TOP SOIL CALCULATION HAS BEEN PRODUCED.
3. PLATEAU LEVEL 54m AOD.
4. EA3-OND-CIV-DRG-SAS-000021-Landscaping_Masterplan-Civils_ONCS FOR LANDCSCAPING DETAILS
5. FOR INTERNAL ROAD & BUILDING DRAINAGE REFER TO RELEVANT SIEMENS DRAWINGS
6. PRIOR TO CONSTRUCTION WORKS, ALL AREAS OF EXCAVATION MUST BE CONFIRMED TO BE FREE OF BURIED SERVICES AND UTILITIES. INFORMATION RELATING TO BURIED SERVICES CONTAINED WITHIN THIS DRAWING ARE NOT DEFINITIVE AND SHOULD BE CONFIRMED ON SITE.
7. INFORMATION ON CONTAMINATED GROUND IS NOT CONTAINED WITHIN THIS DRAWING AND IS TO BE CONFIRMED.
8. PIPE TO BE REMOVED & DITCH TO BE REINSTATED FOLLOWING COMPLETION OF WORKS.

KEY

- SITE BOUNDARY
- MAJOR CONTOURS 0.5m
- MINOR CONTOURS 0.1m
- EXISTING CABLE EA1 WOO1A ACI
- EXISTING CABLE EA1 WOO2A AC2
- EA3 DC
- OIL FILLED CABLE
- SURFACE WATER DRAINAGE
- PROPOSED FENCE
- INTERNAL SITE ROAD & BUILDING DRAINAGE
- DITCHES TO BE STOPPED UP
- PERMANENT ACCESS DURING OPERATION
- TEMPORARY ACCESS
- EXISTING LAND DRAINAGE RETAINED
- PROPOSED TEMPORARY SILT FENCING DURING CONSTRUCTION PHASE - BOUNDING EXISTING LAND DRAINAGE

LOCATION	POINT NUMBER	WGS84 UTM - CULVERTS			
		LATITUDE	LONGITUDE	EASTING	NORTHING
WC01	1	52.075204	1.061164	367127.1891	5771176.3461
WC01	2	52.075097	1.061259	367133.3814	5771164.2730
WC02	3	52.075072	1.061332	337138.3095	5771161.3592
WC02	4	52.075248	1.062040	367187.3484	5771179.6367
WC03	5	52.076499	1.062548	367225.8719	5771317.8299
WC03	6	52.076273	1.062634	367231.0943	5771292.5394

LOCATION	WGS84 UTM			
	LATITUDE	LONGITUDE	EASTING	NORTHING
PLANT REF	52.072948	1.060078	367046.0669	5770927.447
NW	52.074530	1.058851	366966.6164	5771105.6283
NE	52.075182	1.060930	367111.0917	5771174.4390
SE	52.073662	1.062189	367192.7830	5771002.9890
SW	52.073009	1.060111	367048.4411	5770934.1722

Scale:

0 5 10 15 20 25 50

1:500

IFA

IFA = Issued for approval
IFI = Issued for information
IFC = Issued for construction
IFIM = Issued for implementation (Design input)
IFM = Issued for manufacture
AB = As built (Documentation)

Project ID: P-017961	Doc. Key: E	Aspect: C	Customer Document Number:
Customer: East Anglia Three Ltd.			Plant Type / Voltage: HVDC Plus 1200 MW 320 kV DC / 400 kV AC
Project: East Anglia Three			Location(s): East Anglia 3 - Onshore Station
Scale: 1:750			Export Control Classification: ECCN: N AL: N
Responsible Dept.: GP EPC TS LTS	Technical Reference: M. Schönhut	Document Designation: WP731# EA32 &CLD028	Paper Size: A0
Sub-Contractor: SIEMENS energy	Created By: C.Higgins	Document Type: Planning Drawing	Document ID: E4A000000999060
	Approved By: M.Griffiths	Title, Supplementary Title: Sustainable Drainage System Plan	Rev.: 6 Release Date: 2021-08-27 Language: EN Page: 1

Rev.	Rev. Date	Revision Description	Drawn	Checked	Approved
6	27/01/2022	Existing ditch near OH Tower added and extended	G.Jones	M.Griffiths	S.A.Davies
		Temporary gravel bags replacing temp straw bales			
		Temporary silt fencing added around existing ditch			
5	09/12/2021	Fifth Issue	G.Jones	M.Griffiths	S.A.Davies
4	19/11/2021	Fourth Issue	G.Jones	M.Griffiths	S.A.Davies
3	29/10/2021	Third Issue	G.Jones	M.Griffiths	S.A.Davies
2	28/09/2021	Second Issue	G.Jones	M.Griffiths	S.A.Davies
1	27/08/2021	First Issue	C.Higgins	M.Griffiths	S.A.Davies

SCOTTISHPOWER RENEWABLES

ONCS EAST ANGLIA THREE

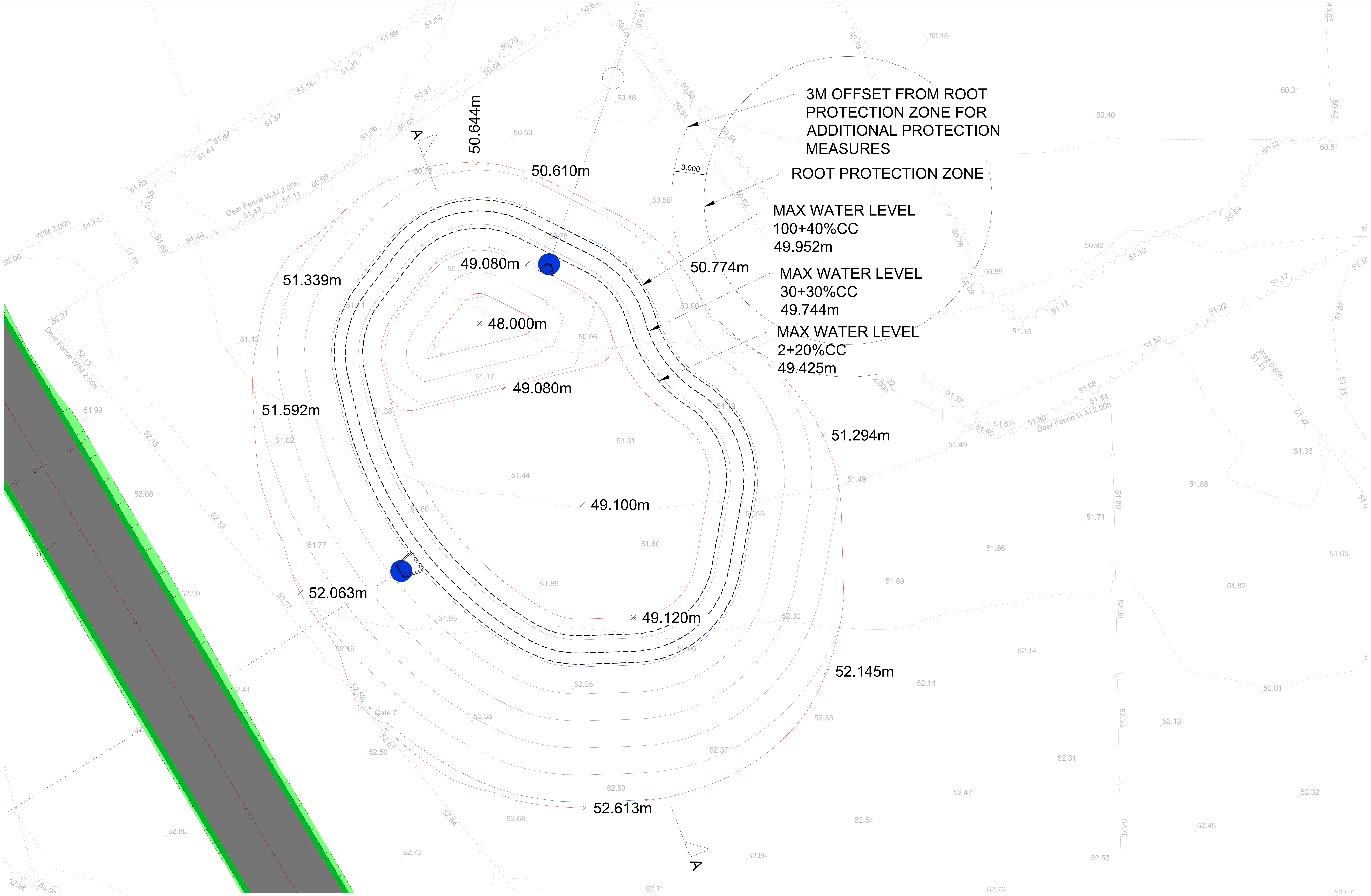
Drg Title

SUSTAINABLE DRAINAGE SYSTEM PLAN

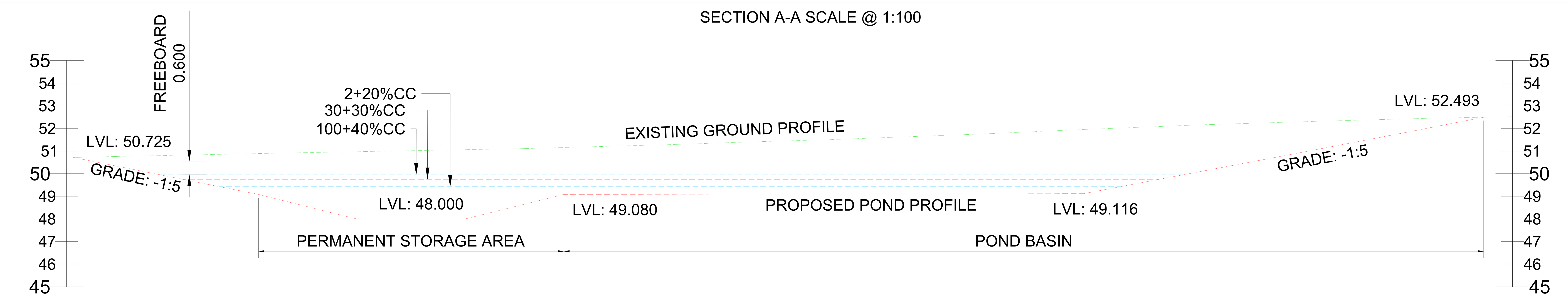
Drg No: EA3-OND-CIV-DRG-SAS-000020 Size: A0

8/9/2021 2:59:30 PM

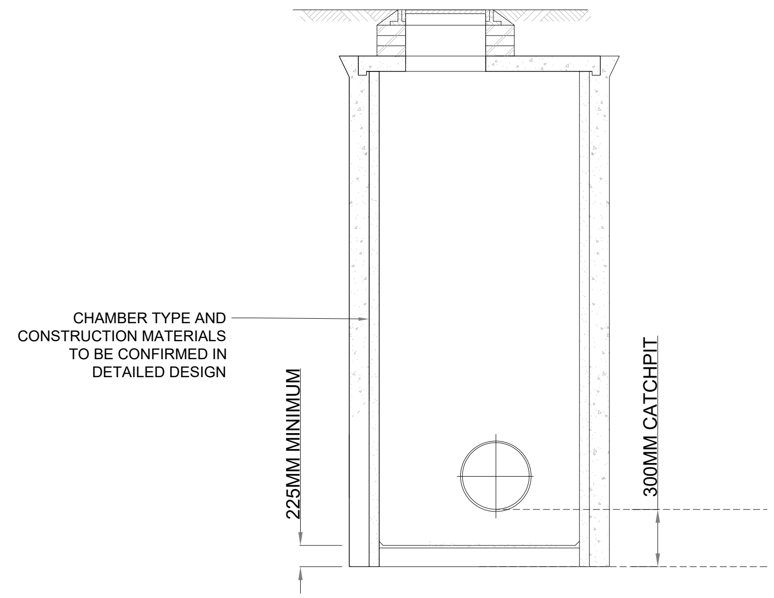
Pond GA and Section



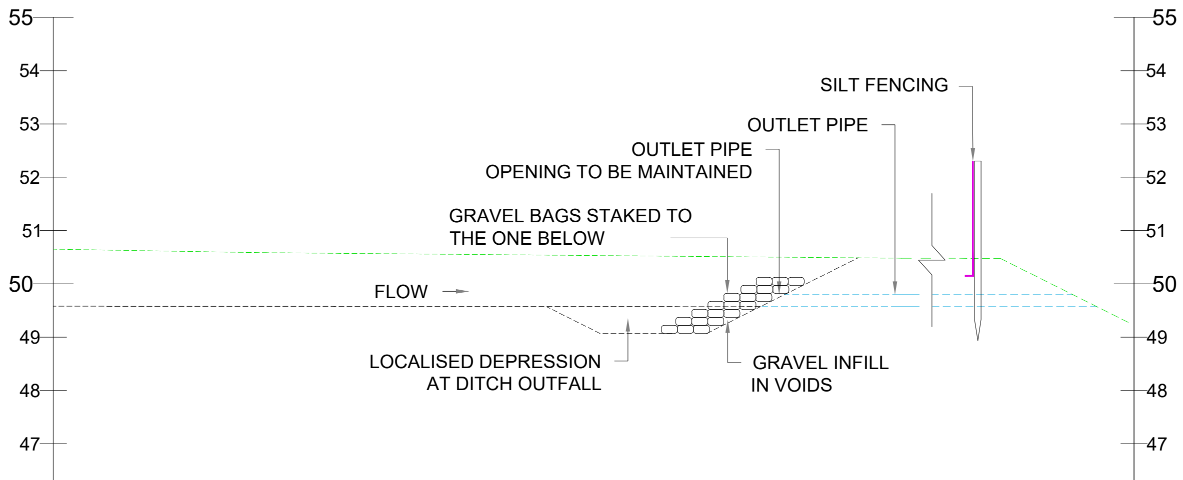
SECTION A-A SCALE @ 1:100



Site Compound Temporary Drainage – Gravel bags and Silt Fencing



TYPICAL CATCHPIT DETAIL
MAX. DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE 3m



DITCH OUTFALL SILT TRAP DETAIL

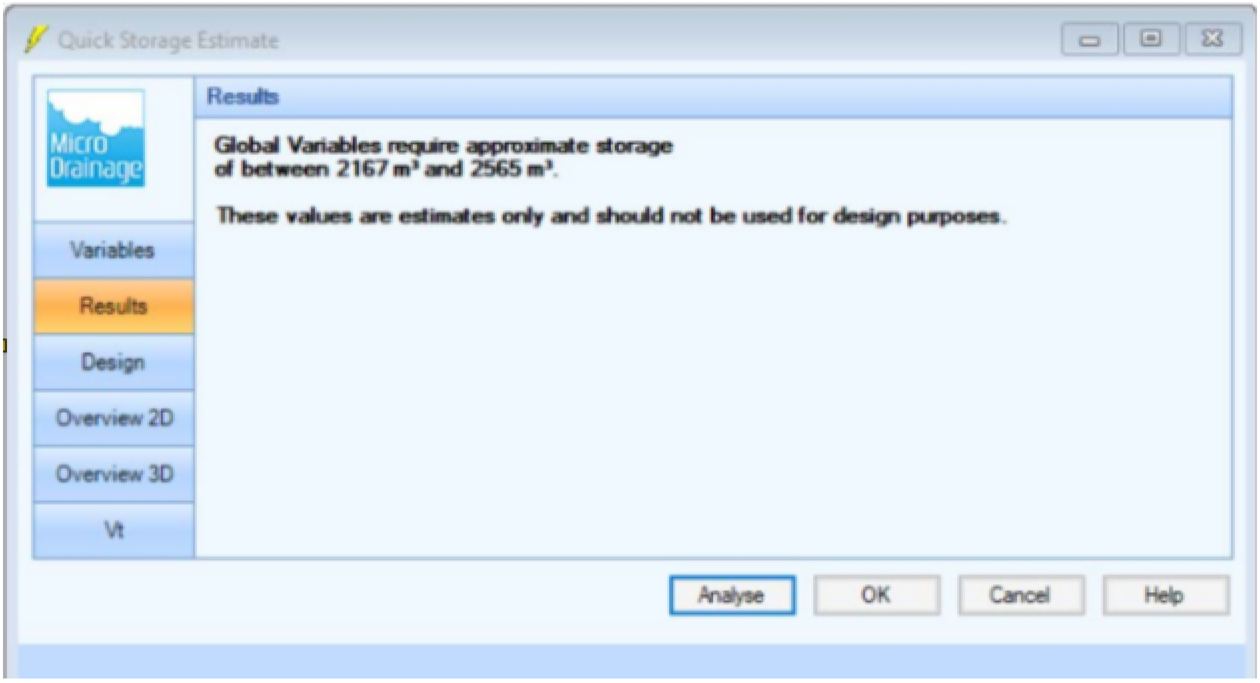
Scale:

SIEMENS
energy

SCOTTISHPOWER
RENEWABLES

Appendix D

Attenuation Storage Calculations



Appendix E

GI Factual Report

Appendix F

1 in 1000 year event

A review of the effects of a 1 in 1000 year storm event was undertaken to determine the effects on the EA3 substation and its effects on the external SuDS drainage features.

EA3 station

Running the microdrainage model produced for the EA3 substation and SuDS drainage (pond and outfall) for the 1 in 1000-year event indicates that the network does not flood internally within the EA3 site and the waters are contained within the network. The risk to flooding of the EA3 site is therefore negated by the design.

Pipe Number	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	63	15 minute 1000 year Winter I+0%	54.650	53.949	0.224	0.000	0.60	7.755	13.5	SURCHARGED
1.001	64	15 minute 1000 year Winter I+0%	54.650	53.892	0.304	0.000	0.65	7.742	13.9	SURCHARGED
1.002	65	15 minute 1000 year Winter I+0%	54.650	53.863	0.252	0.000	1.05	27.134	43.9	SURCHARGED
2.000	4	15 minute 1000 year Winter I+0%	54.650	53.930	0.280	0.000	0.71	2.421	5.0	SURCHARGED
2.001	5	15 minute 1000 year Winter I+0%	54.650	53.919	0.284	0.000	0.71	9.075	16.2	SURCHARGED
1.003	66	15 minute 1000 year Winter I+0%	54.650	53.810	0.245	0.000	1.73	41.303	68.3	SURCHARGED
1.004	67	15 minute 1000 year Winter I+0%	54.650	53.697	0.174	0.000	2.42	46.542	76.6	SURCHARGED
1.005	68	15 minute 1000 year Winter I+0%	54.650	53.599	0.029	0.000	1.53	50.930	83.0	SURCHARGED
1.006	69	15 minute 1000 year Winter I+0%	54.650	53.557	0.015	0.000	1.64	55.608	89.2	SURCHARGED
1.007	70	15 minute 1000 year Winter I+0%	54.650	53.509	-0.080	0.000	0.84	66.690	102.7	OK
1.008	71	15 minute 1000 year Winter I+0%	54.650	53.444	-0.086	0.000	0.99	66.690	99.8	OK
1.009	72	15 minute 1000 year Winter I+0%	54.650	53.382	-0.110	0.000	0.82	72.559	102.4	OK
3.000	13	15 minute 1000 year Winter I+0%	54.650	53.561	-0.089	0.000	0.34	2.693	5.7	OK
1.010	73	15 minute 1000 year Winter I+0%	54.650	53.308	-0.118	0.000	0.89	81.191	107.6	OK
1.011	74	15 minute 1000 year Winter I+0%	54.650	53.133	-0.241	0.000	0.37	81.195	106.5	OK
4.000	26	15 minute 1000 year Winter I+0%	54.650	53.567	-0.108	0.000	0.53	5.915	12.6	OK
4.001	27	30 minute 1000 year Winter I+0%	54.650	53.360	-0.090	0.000	0.54	19.722	24.7	OK
4.002	29	30 minute 1000 year Winter I+0%	54.650	53.345	-0.028	0.000	0.53	19.720	23.5	OK
4.003	30	30 minute 1000 year Winter I+0%	54.650	53.325	0.003	0.000	0.70	27.941	31.6	SURCHARGED
4.004	31	30 minute 1000 year Winter I+0%	54.650	53.306	-0.022	0.000	0.47	34.931	36.9	OK
4.005	32	15 minute 1000 year Winter I+0%	54.650	53.260	0.000	0.000	0.54	31.545	42.9	OK
4.006	33	30 minute 1000 year Winter I+0%	54.650	53.209	0.017	0.000	0.58	50.561	42.1	SURCHARGED
4.007	34	30 minute 1000 year Winter I+0%	54.550	53.195	0.045	0.000	0.34	50.564	44.1	SURCHARGED
1.012	75	30 minute 1000 year Winter I+0%	54.550	53.116	0.000	0.000	1.03	158.238	128.5	OK
5.000	28	15 minute 1000 year Winter I+0%	54.550	54.208	0.658	0.000	0.38	8.157	15.1	SURCHARGED
5.001	52	15 minute 1000 year Winter I+0%	54.550	54.192	0.685	0.000	0.91	21.619	38.2	SURCHARGED
5.002	53	15 minute 1000 year Winter I+0%	54.550	54.162	0.687	0.000	1.50	26.816	46.7	SURCHARGED
5.003	54	15 minute 1000 year Winter I+0%	54.550	54.125	0.673	0.000	2.31	41.846	73.5	SURCHARGED
5.004	32	15 minute 1000 year Winter I+0%	54.550	54.025	0.604	0.000	2.45	41.848	74.5	SURCHARGED
5.005	56	15 minute 1000 year Winter I+0%	54.550	53.938	0.465	0.000	1.80	53.259	93.5	SURCHARGED
5.006	34	15 minute 1000 year Winter I+0%	54.550	53.893	0.443	0.000	1.92	62.057	108.3	SURCHARGED
5.007	58	15 minute 1000 year Winter I+0%	54.550	53.815	0.396	0.000	2.50	77.132	132.9	SURCHARGED
5.008	59	15 minute 1000 year Winter I+0%	54.550	53.692	0.297	0.000	2.70	82.333	141.9	SURCHARGED
5.009	60	15 minute 1000 year Winter I+0%	54.550	53.553	0.106	0.000	1.55	97.574	168.0	SURCHARGED
5.010	38	15 minute 1000 year Winter I+0%	54.550	53.458	0.054	0.000	1.97	106.697	183.6	SURCHARGED
6.000	12	15 minute 1000 year Winter I+0%	54.550	53.754	0.679	0.000	1.29	12.677	25.2	SURCHARGED
6.001	38	15 minute 1000 year Winter I+0%	54.550	53.701	0.592	0.000	1.39	22.674	43.5	SURCHARGED
6.002	39	15 minute 1000 year Winter I+0%	54.550	53.664	0.582	0.000	1.93	32.600	62.0	SURCHARGED
6.003	13	15 minute 1000 year Winter I+0%	54.550	53.599	0.472	0.000	1.38	51.223	96.6	SURCHARGED
6.004	14	15 minute 1000 year Winter I+0%	54.550	53.529	0.445	0.000	1.22	86.456	162.2	SURCHARGED
5.011	61	15 minute 1000 year Winter I+0%	54.550	53.131	0.086	0.000	2.37	203.780	360.6	SURCHARGED
7.000	39	15 minute 1000 year Winter I+0%	54.550	53.725	0.175	0.000	1.20	5.128	9.1	SURCHARGED
7.001	40	15 minute 1000 year Winter I+0%	54.550	53.606	0.071	0.000	0.73	10.089	16.1	SURCHARGED
7.002	41	15 minute 1000 year Winter I+0%	54.550	53.559	0.115	0.000	0.89	12.808	19.0	SURCHARGED
7.003	48	15 minute 1000 year Winter I+0%	54.550	53.510	0.124	0.000	0.95	12.806	20.4	SURCHARGED
7.004	42	15 minute 1000 year Winter I+0%	54.550	53.464	0.137	0.000	1.32	12.808	22.2	SURCHARGED
8.000	48	15 minute 1000 year Winter I+0%	54.550	53.434	-0.116	0.000	0.02	0.000	0.2	OK
7.005	43	15 minute 1000 year Winter I+0%	54.550	53.451	0.141	0.000	1.33	29.638	37.9	SURCHARGED
5.012	16	15 minute 1000 year Winter I+0%	54.550	52.785	-0.389	0.000	0.47	236.843	402.7	OK
1.013	62	15 minute 1000 year Winter I+0%	54.550	51.296	-0.154	0.000	0.93	356.083	479.4	OK
1.014	51	15 minute 1000 year Winter I+0%	54.550	50.868	-0.382	0.000	0.48	356.079	472.0	OK
1.015	52	480 minute 1000 year Winter I+0	50.550	50.170	0.340	0.000	0.61	427.273	44.4	SURCHARGED
1.016	53	360 minute 1000 year Winter I+0	50.550	50.550	0.720	0.482	0.01	308.617	8.3	FLOOD

From the results it can be seen that the hydrobrake chamber (pipe 1.016 – chamber 53) flood in the 1000-year event. This is offsite away from the EA3 station, and the volume of flooding is minimal equating to approximately 0.5m³ of flooding. This flood water, as depicted in Figure 3 and Figure 8, would fall towards the existing land drainage. Additionally, an increase in flow through the hydrobrake from the permitted 8.1l/s to 8.3l/s would occur.

It is deemed that this system performs adequately to contain and mitigate against significant adverse effects pertaining to a 1 in 1000-year return period storm event, protecting the EA3 development and having minimal flooding from the network.

Overland flow from the EA1 Substation

As assessment of the flood waters from the EA1 substation, located on the eastern side of the EA3 development was undertaken to ascertain the impacts this may have on the development. from the calculations (as can be seen on the following page, flooding of the networks does occurs at a volume of 135.8m³. when taking into consideration the influenced area (as depicted on the following page) of 6380m², the total flood depth equates to 21mm, which in also consequently stored within the gravel areas and road for a short period of time. The flooded depth calculated indicates that there will be no negative impact on the EA3 development and will not impact on the building within the area. Therefore, it is deemed that design is adequate and protected against the 1 in 1000 year event within overland flow from the EA1 compound.

With Climate change factor as 0% for rain event of 1 in 1000 yrs.

Critical Summary of Results by Maximum Level (Rank 1)

Pipe Number	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	63	30 minute 1000 year Wint	54.650	54.713	0.988	62.738	2.25		56.4	FLOOD
1.001	64	15 minute 1000 year Wint	54.650	54.319	0.732	0.000	2.38		56.4	SURCHARGED
1.002	65	15 minute 1000 year Wint	54.650	54.140	0.529	0.000	1.77		81.9	SURCHARGED
2.000	4	15 minute 1000 year Wint	54.650	54.087	0.437	0.000	0.64		4.9	SURCHARGED
2.001	5	15 minute 1000 year Wint	54.650	54.079	0.444	0.000	0.51		12.6	SURCHARGED
1.003	66	30 minute 1000 year Wint	54.650	54.030	0.465	0.000	2.12		92.9	SURCHARGED
1.004	67	30 minute 1000 year Wint	54.650	53.878	0.354	0.000	2.85		98.7	SURCHARGED
1.005	68	30 minute 1000 year Wint	54.650	53.722	0.152	0.000	1.76		104.2	SURCHARGED
1.006	69	30 minute 1000 year Wint	54.650	53.670	0.127	0.000	1.86		110.4	SURCHARGED
1.007	70	30 minute 1000 year Wint	54.650	53.611	0.021	0.000	0.91		124.8	SURCHARGED
1.008	71	30 minute 1000 year Wint	54.650	53.566	0.036	0.000	1.13		123.4	SURCHARGED
1.009	72	30 minute 1000 year Wint	54.650	53.527	0.034	0.000	0.88		122.3	SURCHARGED
3.000	13	15 minute 1000 year Wint	54.650	53.558	-0.092	0.000	0.31		5.7	OK
1.010	73	30 minute 1000 year Wint	54.650	53.477	0.051	0.000	0.94		126.1	SURCHARGED
1.011	74	30 minute 1000 year Wint	54.650	53.429	0.055	0.000	0.44		126.3	SURCHARGED
4.000	26	30 minute 1000 year Wint	54.650	54.717	1.042	66.983	2.92		78.5	FLOOD
4.001	27	15 minute 1000 year Wint	54.650	54.656	1.206	6.107	2.71		138.3	FLOOD
4.002	29	30 minute 1000 year Wint	54.650	54.349	0.976	0.000	2.49		122.0	SURCHARGED
4.003	30	30 minute 1000 year Wint	54.650	54.115	0.794	0.000	2.43		123.1	SURCHARGED
4.004	31	30 minute 1000 year Wint	54.650	53.764	0.436	0.000	1.43		126.8	SURCHARGED
4.005	32	30 minute 1000 year Wint	54.650	53.635	0.375	0.000	1.48		131.7	SURCHARGED
4.006	33	30 minute 1000 year Wint	54.650	53.486	0.294	0.000	1.77		139.3	SURCHARGED

Flood water volume for 1 in 1000 years rain event = 135.8 cum
Influenced catchment area = 6380 sqm
Therefore, height of flood water = 21mm

Appendix G

Study Limitations

This appendix should be read before reliance is placed on any of the information, opinions, advice, recommendations, or conclusions contained in this report.

1. This report has been prepared by Arcadis (UK) Limited (Arcadis), with the reasonable skill, care, and diligence within the terms of the Appointment and with the resources and manpower agreed with the Client. Arcadis does not accept responsibility for any matters outside the agreed scope.
2. This report has been prepared for the sole benefit of the Client unless agreed otherwise in writing. The contents of this report may not be used or relied upon by any person other than this party without the express written consent and authorisation of Arcadis.
3. Unless stated otherwise, no consultations with authorities or funders or other interested third parties have been carried out. Arcadis are unable to give categorical assurance that the findings will be accepted by these third parties as such bodies may have unpublished, more stringent objectives. Further work may be required by these parties.
4. All work carried out in preparing this report has used, and is based on, Arcadis' professional knowledge and understanding of current relevant legislation. Changes in legislation or regulatory guidance may cause the opinion or advice contained in this report to become inappropriate or incorrect. In giving opinions and advice, pending changes in legislation, of which Arcadis is aware, have been considered. Following delivery of the report, Arcadis have no obligation to advise the Client or any other party of such changes or their repercussions.
5. This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report.
6. Whilst this report and the opinions made are correct to the best of Arcadis' belief, Arcadis cannot guarantee the accuracy or completeness of any information provided by third parties. Arcadis has taken reasonable steps to ensure that the information sources used for this investigation provided accurate information and has therefore assumed this to be the case.
7. This report has been prepared based on the information reasonably available during the project programme. All information relevant to the scope may not have been received.
8. This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of changes in the condition of the site since the time of the investigation.
9. The content of this report represents the professional opinion of experienced Engineers. Arcadis does not provide specialist legal or other professional advice. The advice of other professionals may be required.
10. Unless otherwise stated the report provides no comment on the nature of building materials, operational integrity of the facility or on any regulatory compliance issues.
11. Unless otherwise stated, samples from the site (soil, groundwater, building fabric or other samples) have not been obtained.
12. Arcadis has relied upon the accuracy of documents, oral information and other material and information provided by the Client and others, and Arcadis assumes no liability for the accuracy of such data, although in the event of apparent conflicts in information, Arcadis would highlight this and seek to resolve.

Unless otherwise stated, the scope of works has not included an environmental compliance review, health and safety compliance review, hazardous building materials assessment, Interviews or contacting Local Authority, requests for information to the petroleum officer, sampling or analyses of soil, ground water, surface water, air or hazardous building materials or a chain of title review

Arcadis (UK) Limited

Arcadis House,
St Mellons Business Park,
Fortran Rd,
St. Mellons,
Cardiff
CF3 0EY

T: +44 (0)1925 800 700

arcadis.com

APPENDIX 2 OVERALL DRAINAGE LAYOUTS

NOTES

1. DO NOT SCALE FROM DRAWING USE FIGURED DIMENSIONS ONLY.
2. SITE AREA IS ASSUMED TO BE MADE GROUND SO NO TOP SOIL CALCULATION HAS BEEN PRODUCED.
3. PLATEAU LEVEL 54m AOD.
4. EA3-OND-CIV-DRG-SAS-000021-Landscaping_Masterplan-Civils_ONCS FOR LANDCSCAPING DETAILS
5. FOR INTERNAL ROAD & BUILDING DRAINAGE REFER TO RELEVANT SIEMENS DRAWINGS
6. PRIOR TO CONSTRUCTION WORKS, ALL AREAS OF EXCAVATION MUST BE CONFIRMED TO BE FREE OF BURIED SERVICES AND UTILITIES. INFORMATION RELATING TO BURIED SERVICES CONTAINED WITHIN THIS DRAWING ARE NOT DEFINITIVE AND SHOULD BE CONFIRMED ON SITE.
7. INFORMATION ON CONTAMINATED GROUND IS NOT CONTAINED WITHIN THIS DRAWING AND IS TO BE CONFIRMED.
8. PIPE TO BE REMOVED & DITCH TO BE REINSTATED FOLLOWING COMPLETION OF WORKS.

KEY

- SITE BOUNDARY
- MAJOR CONTOURS 0.5m
- MINOR CONTOURS 0.1m
- EXISTING CABLE EA1 WOO1A ACI
- EXISTING CABLE EA1 WOO2A AC2
- EA3 DC
- OIL FILLED CABLE
- POTABLE WATER
- SURFACE WATER DRAINAGE
- PROPOSED FENCE
- INTERNAL SITE ROAD & BUILDING DRAINAGE
- DITCHES TO BE STOPPED UP
- PERMANENT ACCESS DURING OPERATION
- TEMPORARY ACCESS
- EXISTING LAND DRAINAGE RETAINED
- PROPOSED TEMPORARY SILT FENCING DURING CONSTRUCTION PHASE - BOUNDING EXISTING LAND DRAINAGE

LOCATION	POINT NUMBER	OSGB36 - CULVERTS LATITUDE	LONGITUDE	EASTING	NORTHING
WC01	1	52.075212	1.061156	609753.1770	246340.1300
WC01	2	52.075091	1.061263	609761.0590	246327.0600
WC02	3	52.075164	1.061646	609786.9350	246336.2650
WC02	4	52.075199	1.061878	609802.6540	246340.8520

LOCATION	OSGB36 LATITUDE	LONGITUDE	EASTING	NORTHING
PLANT REF	52.072948	1.060078	609689.9280	246085.3610
NW	52.074530	1.058850	609598.3980	246257.6460
NE	52.075183	1.060930	609737.7670	246336.2350
SE	52.073662	1.062188	609831.1380	246170.8590
SW	52.073009	1.060110	609691.8230	246092.1740

Scale:
0 5 10 15 20 25 50
1:500

IFA

IFA = Issued for approval
IFI = Issued for information
IFC = Issued for construction
IFIM = Issued for implementation (Design input)
IFM = Issued for manufacture
AB = As built (Documentation)

Project ID: P-017961 | Doc. Key: E | Aspect: C | Customer Document Number:
Plant Type / Voltage: HVDC Plus 1200 MW, 320 kV DC / 400 kV AC
Customer: East Anglia Three Ltd.
Project: East Anglia Three
Location(s): East Anglia 3 - Onshore Station
Scale: 1:750
Export Control Classification: ECCN: N AL: N
Responsible Dept.: GP EPC TS LTS
Technical Reference: M. Schönhut
Document Designation: WP731# EA32 &CLD028
Paper Size: A0
Sub-Contractor:
Created By: C.Higgins
Document Type: Planning Drawing
Document ID: E4A000000999060
SIEMENS energy
Approved By: M.Griffiths
Title, Supplementary Title: Sustainable Drainage System Plan
Rev.: 9 | Release Date: 2022-04-04 | Language: EN | Page: 1/3

Rev.	Rev. Date	Revision Description	Drawn	Checked	Approved
9	04/04/2022	SWHW2 and SW MH13 emergency shutoff clarified	G.Jones	C.Higgins	M.Griffiths
8	15/03/2022	Pond and construction access update	G.Jones	C.Higgins	M.Griffiths
7	22/02/2022	WC002 to be permanent culvert	G.Jones	C.Higgins	M.Griffiths
6	27/01/2022	Existing ditch near OH Tower added and extended	G.Jones	M.Griffiths	S.A.Davies
		Temporary gravel bags replacing temp straw bales			
		Temporary silt fencing added around existing ditch			
5	09/12/2021	Fifth Issue	G.Jones	M.Griffiths	S.A.Davies
4	19/11/2021	Fourth Issue	G.Jones	M.Griffiths	S.A.Davies
3	29/10/2021	Third Issue	G.Jones	M.Griffiths	S.A.Davies
2	28/09/2021	Second Issue	G.Jones	M.Griffiths	S.A.Davies

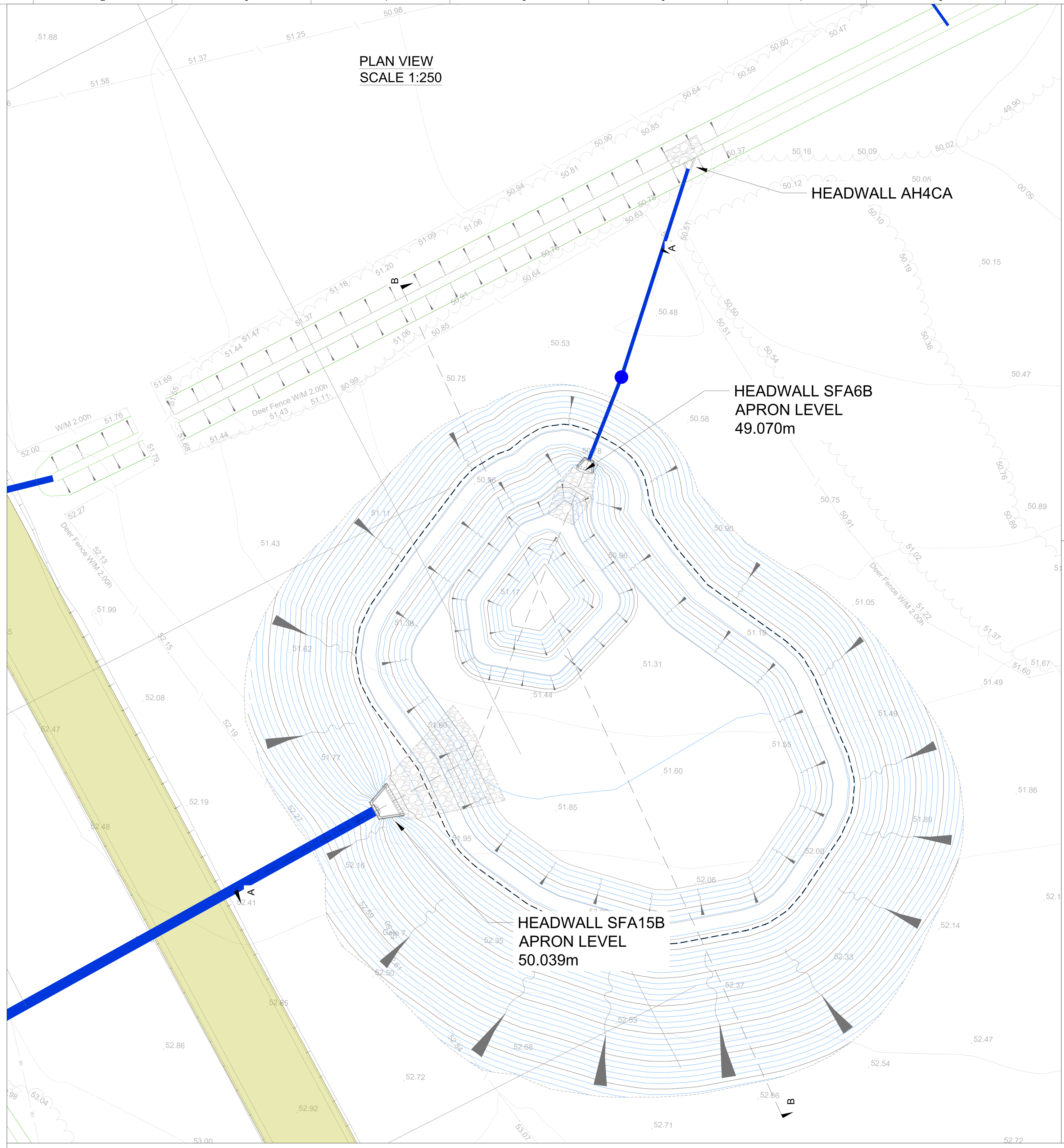
SCOTTISHPOWER RENEWABLES

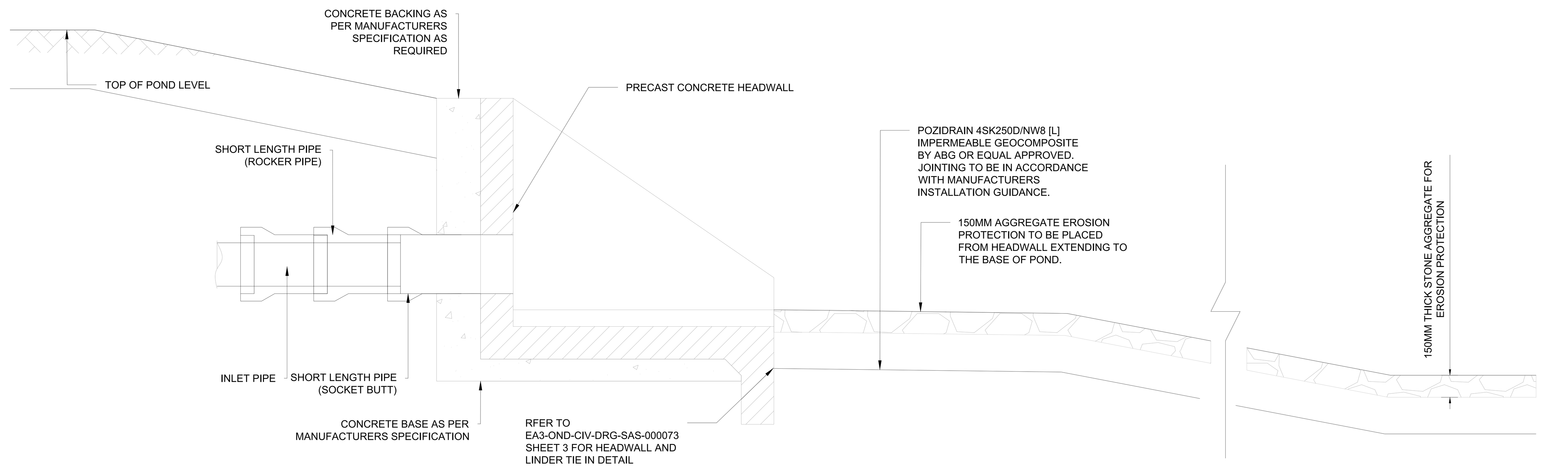
ONCS EAST ANGLIA THREE

Drg Title: SUSTAINABLE DRAINAGE SYSTEM PLAN

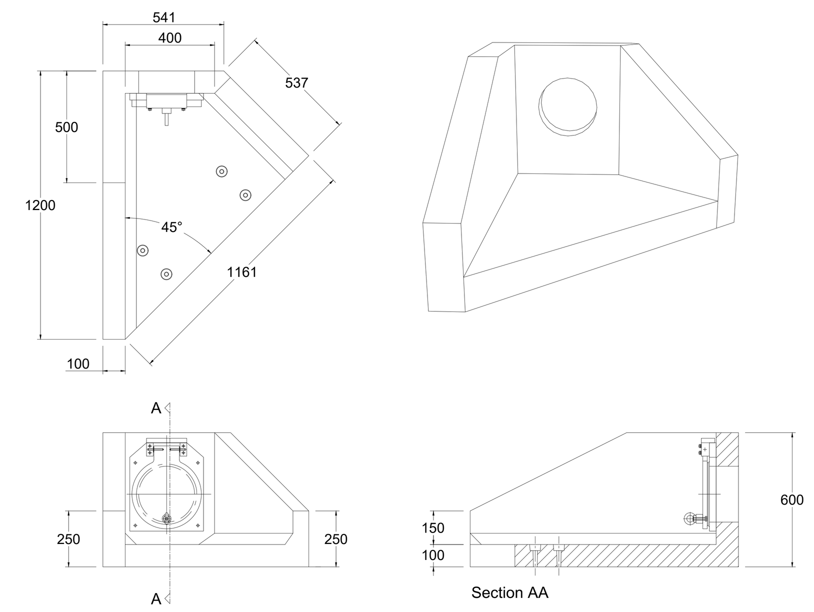
Drg No: EA3-OND-CIV-DRG-SAS-000020 | Size: A0

8/9/2021 2:59:30 PM

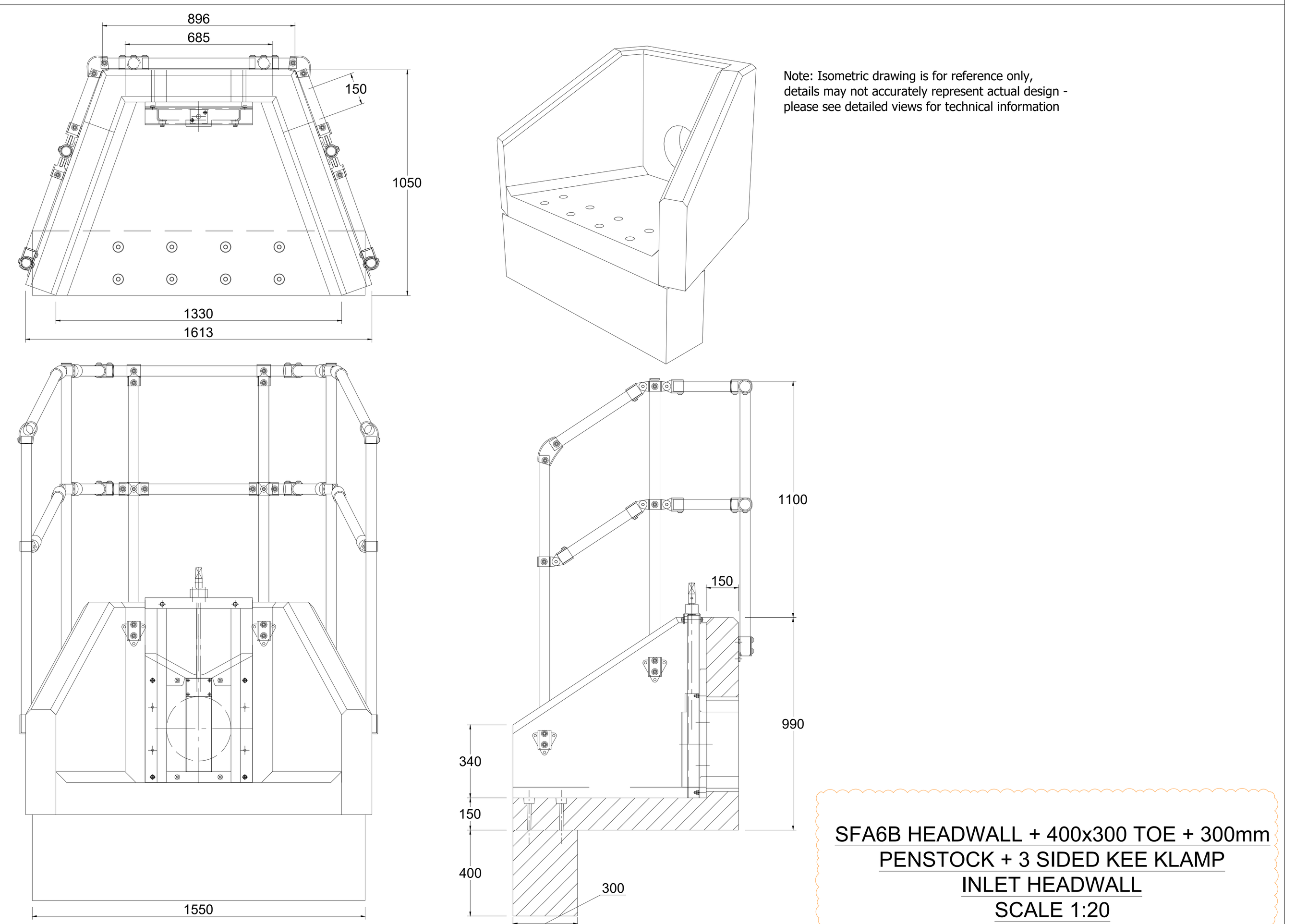




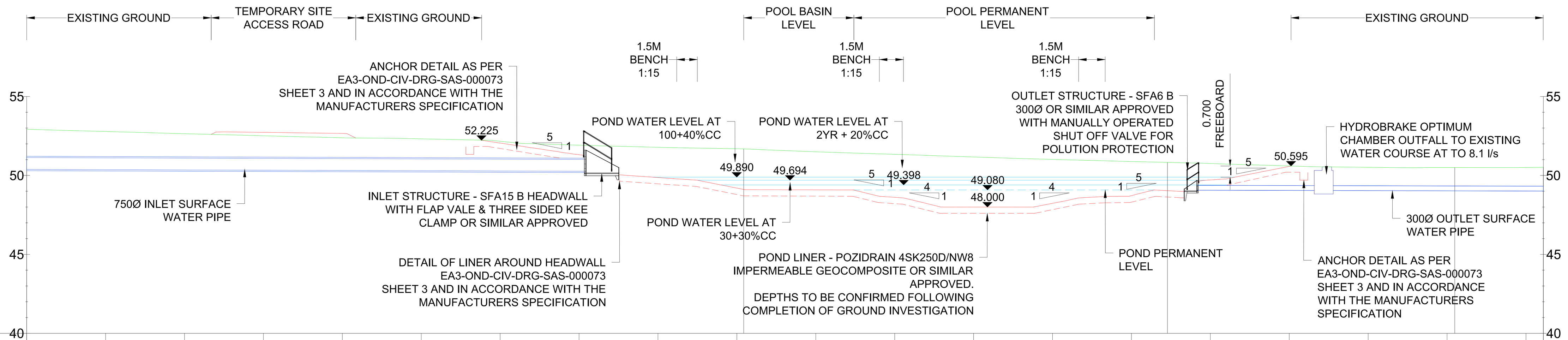
HEADWALL EROSION PROTECTION
SCALE 1:20



AH4CA LH HEADWALL + FLAP VALVE
SCALE 1:20

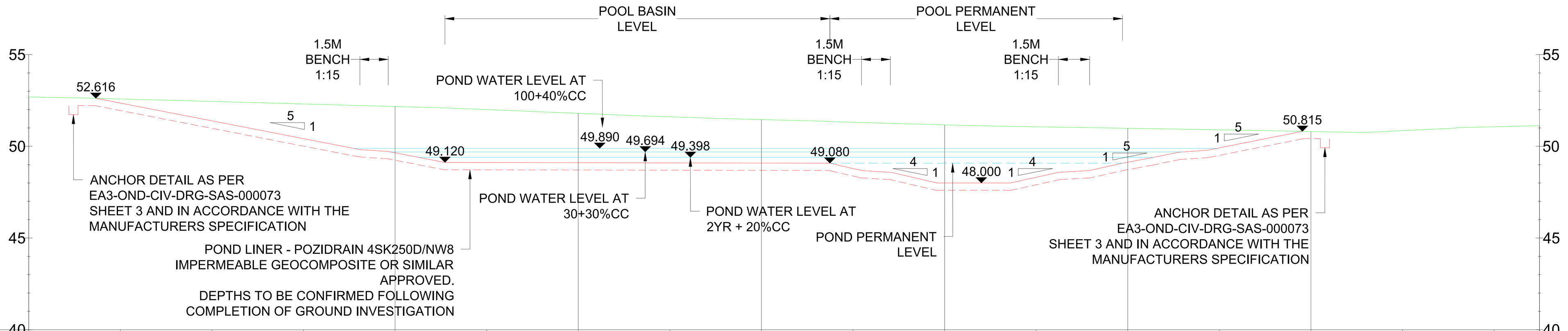


SFA6B HEADWALL + 400x300 TOE + 300mm PENSTOCK + 3 SIDED KEE KLAMP INLET HEADWALL
SCALE 1:20



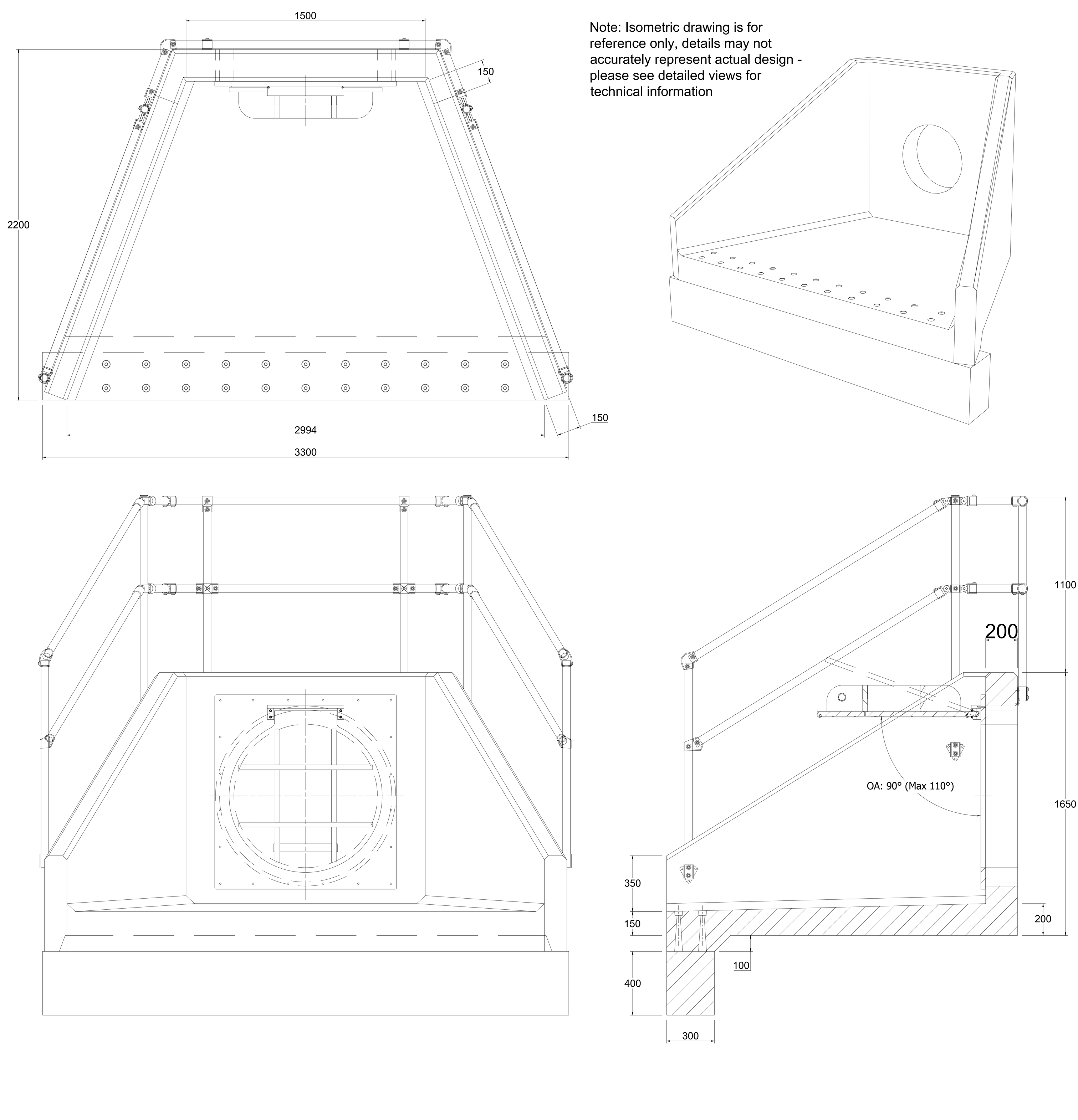
Pons Section A-A
SCALE: H 1:200,V 1:200
DATUM: 40.000

CHAINAGE	00.00	05.00	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	96.10
SURVEY LEVELS	52.923	52.784	52.644	52.514	52.384	52.321	52.167	51.917	51.787	51.690	51.498	51.338	51.170	51.017	50.884	50.754	50.599	50.516	50.505	50.506	50.515
PROPOSED LEVELS				52.727	52.661		52.052	51.313	49.867	49.198	49.087	48.616	48.000	48.236	48.721	49.714	50.573				



Pond Section B-B
SCALE: H 1:200,V 1:200
DATUM: 40.000

CHAINAGE	00.00	05.00	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00	82.48
SURVEY LEVELS	52.691	52.580	52.445	52.307	52.167	52.004	51.798	51.606	51.458	51.314	51.171	51.063	50.982	50.898	50.807	50.853	51.064	51.124
PROPOSED LEVELS		52.357	51.387	50.417	49.648	49.116	49.106	49.097	49.087	48.788	48.000	48.313	49.133	49.915				



SFA15B HEADWALL + 400 X 300MM TOE + 800MM FLAP VALVE + 3 SIDED KEE KLAMP
SCALE 1:20

NOTES
1. DO NOT SCALE FROM DRAWING USE FIGURED DIMENSIONS ONLY.

Scale:
0 5 10 15 20 25 50
1:500

IFA	IFA = Issued for approval IFI = Issued for information IFC = Issued for construction	IFIM = Issued for implementation (Design input) IFM = Issued for manufacture AB = As built (Documentation)

Project ID: P-017961 | Doc. Key: E | Aspect: C | Customer Document Number:
Plant Type / Voltage: HVDC Plus 1200 MW, 320 kV DC / 400 kV AC
Customer: East Anglia Three Ltd.
Project: East Anglia Three
Location(s): East Anglia 3 - Onshore Station
Scale: AS SHOWN
Export Control Classification: ECCN: N AL: N
Responsible Dept.: GP EPC TS LTS
Technical Reference: M. Schönhut
Document Designation: WP731# EA32 &CLD028
Paper Size: A0
Sub-Contractor:
Created By: C.Higgins
Document Type: Planning Drawing
Document ID: E4A000000999060
SIEMENS energy
Approved By: M.Griffiths
Title, Supplementary Title: Sustainable Drainage System Plan
Rev.: 9 | Release Date: 2022-04-04 | Language: EN | Page: 2/3

Rev.	Rev. Date	Revision Description	Drawn	Checked	Approved
9	04/04/2022	SWHW2 and SW MH13 emergency shutoff clarified	G.Jones	C.Higgins	M.Griffiths
8	15/03/2022	Pond and construction access update	G.Jones	C.Higgins	M.Griffiths
7	22/02/2022	WC002 to be permanent culvert	G.Jones	C.Higgins	M.Griffiths
6	27/01/2022	Existing ditch near OH Tower added and extended	G.Jones	M.Griffiths	S.A.Davies
		Temporary gravel bags replacing temp straw bales			
		Temporary silt fencing added around existing ditch			
5	09/12/2021	Fifth Issue	G.Jones	M.Griffiths	S.A.Davies
4	19/11/2021	Fourth Issue	G.Jones	M.Griffiths	S.A.Davies
3	29/10/2021	Third Issue	G.Jones	M.Griffiths	S.A.Davies
2	28/09/2021	Second Issue	G.Jones	M.Griffiths	S.A.Davies

SCOTTISHPOWER RENEWABLES

ONCS EAST ANGLIA THREE

Drg Title
SUSTAINABLE DRAINAGE POND DETAILS

Drg No: EA3-OND-CIV-DRG-SAS-000020 | Size: A0

8/9/2021 2:59:30 PM

NOTES

1. DO NOT SCALE FROM DRAWING USE FIGURED DIMENSIONS ONLY.

KEY

OVERLAND FLOW DIRECTION

EXISTING LAND DITCHES RETAINED

Scale:

0 5 10 15 20 25 50

1:500

IFA	IFA = Issued for approval IFIM = Issued for implementation (Design input) IFI = Issued for information IFM = Issued for manufacture IFC = Issued for construction AB = As built (Documentation)

Project ID P-017961	Doc. Key E	Aspect C	Customer Document Number	Plant Type / Voltage HVDC Plus 1200 MW 320 kV DC / 400 kV AC
Customer East Anglia Three Ltd.				
Project East Anglia Three				Location(s) East Anglia 3 - Onshore Station
Scale 1:750				Export Control Classification: ECCN: N AL: N
Responsible Dept. GP EPC TS LTS	Technical Reference M. Schönhut	Document Designation WP731# EA32 &CLD028		Paper Size A0
Sub-Contractor	Created By C.Higgins	Document Type Planning Drawing		Document ID E4A000000999060
SIEMENS energy	Approved By M.Griffiths	Title, Supplementary Title Sustainable Drainage System Plan		Rev. 9 / Release Date 2022-04-04 / Language EN / Page 3/3

9	04/04/2022	SWHW2 and SW MH13 emergency shutoff clarified	G.Jones	C.Higgins	M.Griffiths
8	15/03/2022	Pond and construction access update	G.Jones	C.Higgins	M.Griffiths
7	22/02/2022	WC002 to be permanent culvert	G.Jones	C.Higgins	M.Griffiths
6	27/01/2022	Existing ditch near OH Tower added and extended	G.Jones	M.Griffiths	S.A.Davies
		Temporary gravel bags replacing temp straw bales			
		Temporary silt fencing added around existing ditch			
5	09/12/2021	Fifth Issue	G.Jones	M.Griffiths	S.A.Davies
4	19/11/2021	Fourth Issue	G.Jones	M.Griffiths	S.A.Davies
3	29/10/2021	Third Issue	G.Jones	M.Griffiths	S.A.Davies
2	28/09/2021	Second Issue	G.Jones	M.Griffiths	S.A.Davies
Rev.	Rev. Date	Revision Description	Drawn	Checked	Approved

SCOTTISHPOWER RENEWABLES

ONCS EAST ANGLIA THREE

Drg Title

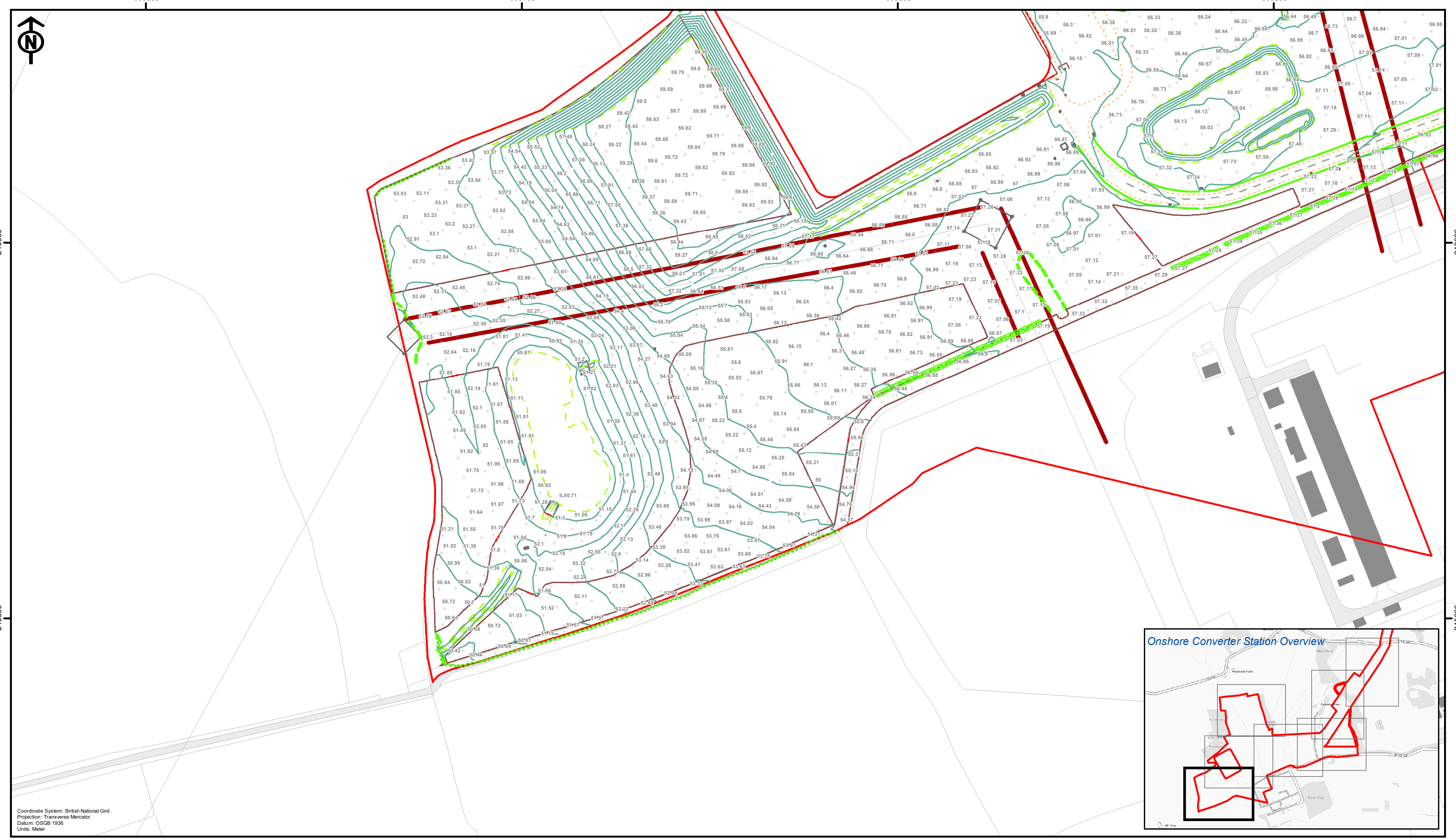
SUSTAINABLE DRAINAGE
OVERLAND FLOW PATHS

Drg No EA3-OND-CIV-DRG-SAS-000020

Size A0

8/9/2021 2:59:30 PM

APPENDIX 3 TOPOGRAPHICAL PLANS



EA THREE DCO Corridor	Overhead Telecom	Hedge	Structure
	Structure Overhead	Tree	Wall
Topographic Survey Legend	Banking	Tree Canopy	Road Centreline
Spot Height (m)	Fence	Vegetation Extent	Contour Line
Overhead Electicity	Gate	Surface Edge	

GoBe consultants

Rev	Date	By	Comment
A	24/01/2022	PW	First Issue

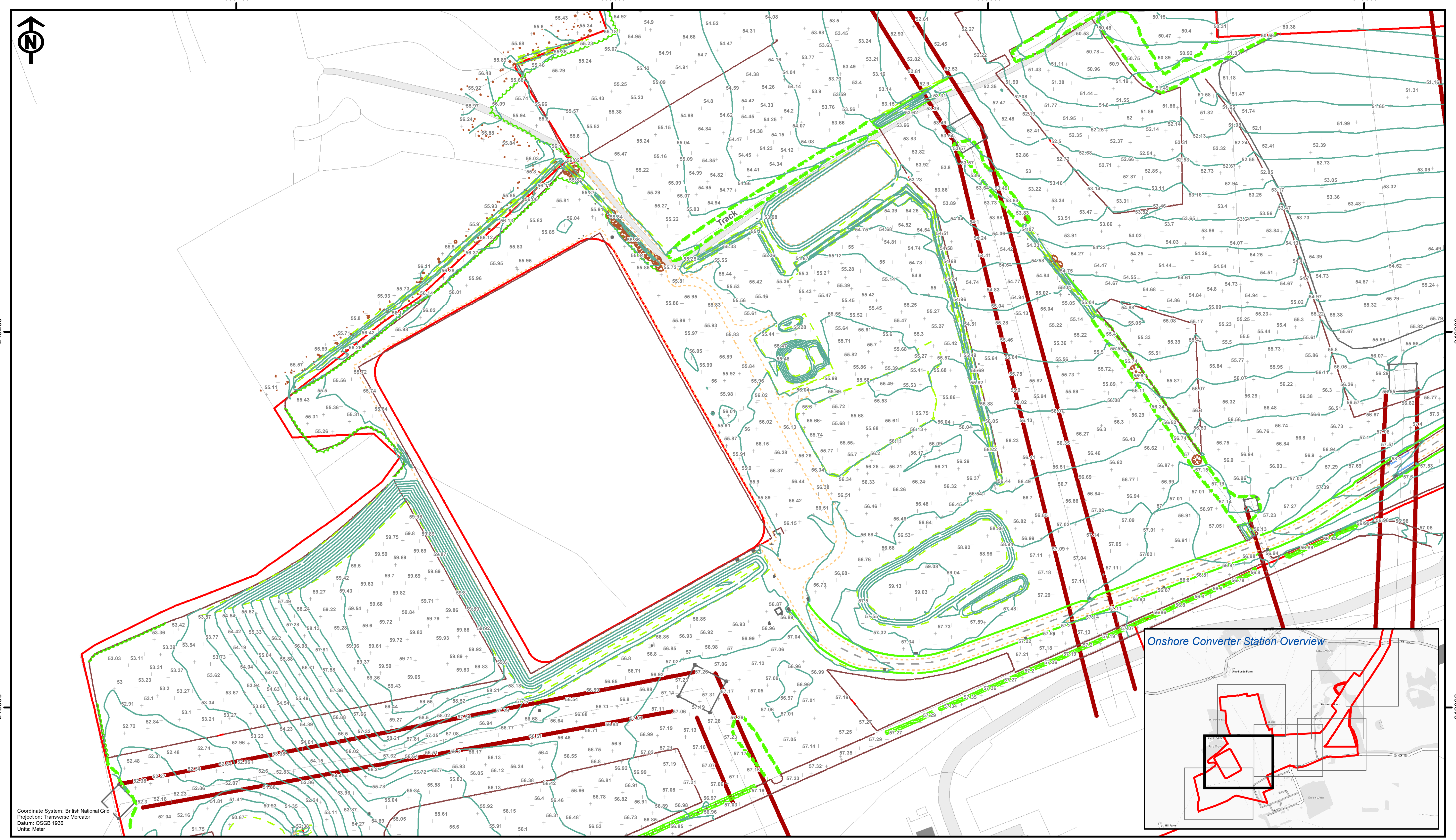
Original A3 Plot Scale 1:2,000

0 40 80 Metres

Onshore Converter Station Stage

Appendix: ONCS Topography

Drg No	05356.00006.12.0063.0 ONCS Topography
Rev	1
Date	24/01/2022
Layout	N/A



EA THREE DCO Corridor

Topographic Survey Legend

- Spot Height (m)
- Overhead Electicity
- Overhead Telecom
- Structure Overhead
- Banking
- Fence
- Gate
- Hedge
- Tree
- Tree Canopy
- Vegetation Extent
- Surface Edge
- Structure
- Wall
- Road Centreline
- Contour Line

GoBe consultants

Rev	Date	By	Comment
A	24/01/2022	PW	First Issue

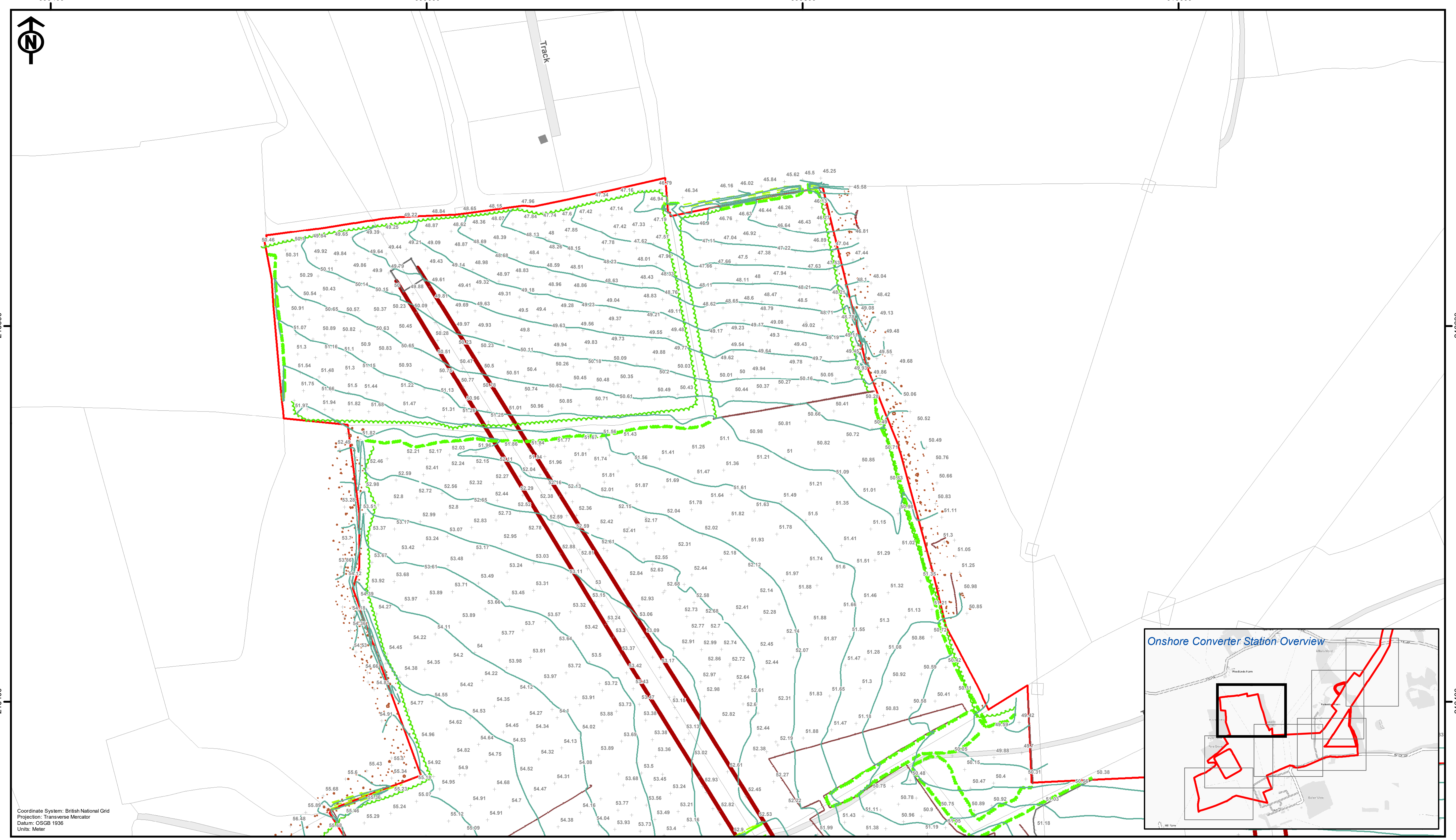
Original A3 Plot Scale 1:2,000

0 40 80 Metres

Onshore Converter Station Stage

Appendix: ONCS Topography

Drg No	05356.00006.12.0063.0 ONCS Topography
Rev	1
Date	24/01/2022
Layout	N/A



EA THREE DCO Corridor	Overhead Telecom
	Structure Overhead
	Banking
	Fence
	Gate
Hedge	Structure
Tree	Wall
Tree Canopy	Road Centreline
Vegetation Extent	Contour Line
Surface Edge	

Topographic Survey Legend

- Spot Height (m)
- Overhead Electicity

GoBe consultants

Rev	Date	By	Comment
A	24/01/2022	PW	First Issue

Original A3 Plot Scale 1:2,000

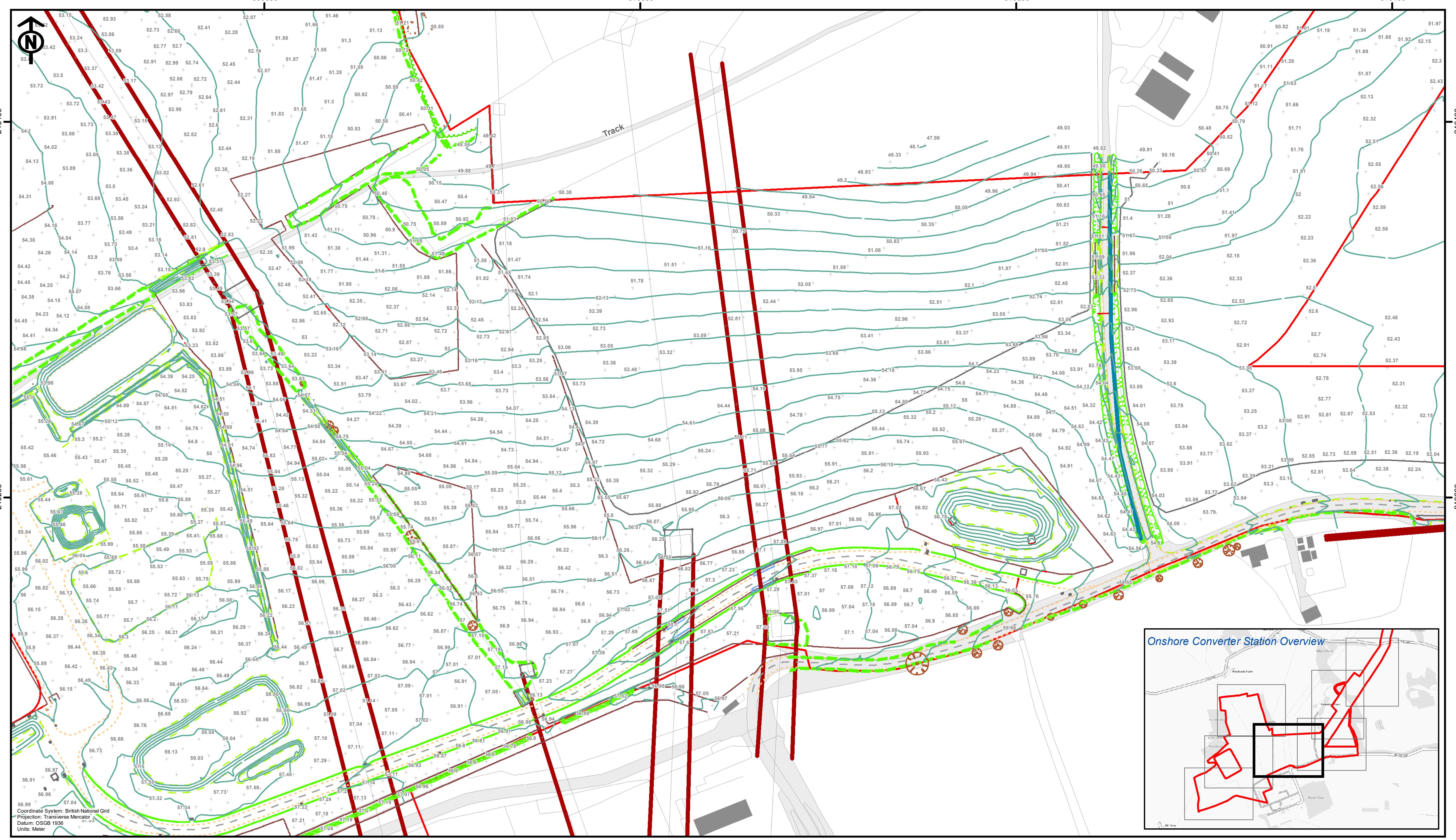
0 40 80 Metres

Onshore Converter Station Stage

Appendix: ONCS Topography

Drg No	05356.00006.12.0063.0 ONCS Topography
Rev	1
Date	24/01/2022
Layout	N/A

Document Path: \\gisfs1\G\Projects\05356 - GoBe Consultants Ltd\00006 East Anglia Three\Tech\GIS\Dwgs\Wking\EA3\Onshore Substation\Doc Ref EA3-GRD-CON-PLN-IBR-000107\ONCS\5356.00006.12.0073.0 Appendix Topology.mxd



EA THREE DCO Corridor	Overhead Electicity	Gate	Surface Edge
	Overhead Telecom	Hedge	Structure
	Structure Overhead	Tree	Wall
Topographic Survey Legend	Banking	Tree Canopy	Road Centreline
Spot Height (m)	Fence	Vegetation Extent	Contour Line

GoBe consultants

A	24/01/2022	PW	First Issue
Rev	Date	By	Comment

Original A3 Plot Scale 1:2,000

0 40 80 Metres

Onshore Converter Station Stage

Appendix: ONCS Topography

Drg No	05356.00006.12.0063.0 ONCS Topography
Rev	1
Date	24/01/2022
Layout	N/A

Document Path: \\gisfs1\G\Projects\05356 - GoBe Consultants Ltd\00006 East Anglia Three\Tech\GIS\Dwgs\Wking\EA3\Onshore Substation\Doc Ref EA3-GRD-CON-PLN-IBR-000107\ONCS\5356.00006.12.0073.0 Appendix Topology.mxd

EA THREE DCO Corridor	Overhead Electicity	Gate	Surface Edge
	Overhead Telecom	Hedge	Structure
	Structure Overhead	Tree	Wall
Topographic Survey Legend	Banking	Tree Canopy	Road Centreline
Spot Height (m)	Fence	Vegetation Extent	Contour Line

GoBe consultants

Rev	Date	By	Comment
A	24/01/2022	PW	First Issue

Original A3 Plot Scale 1:2,000

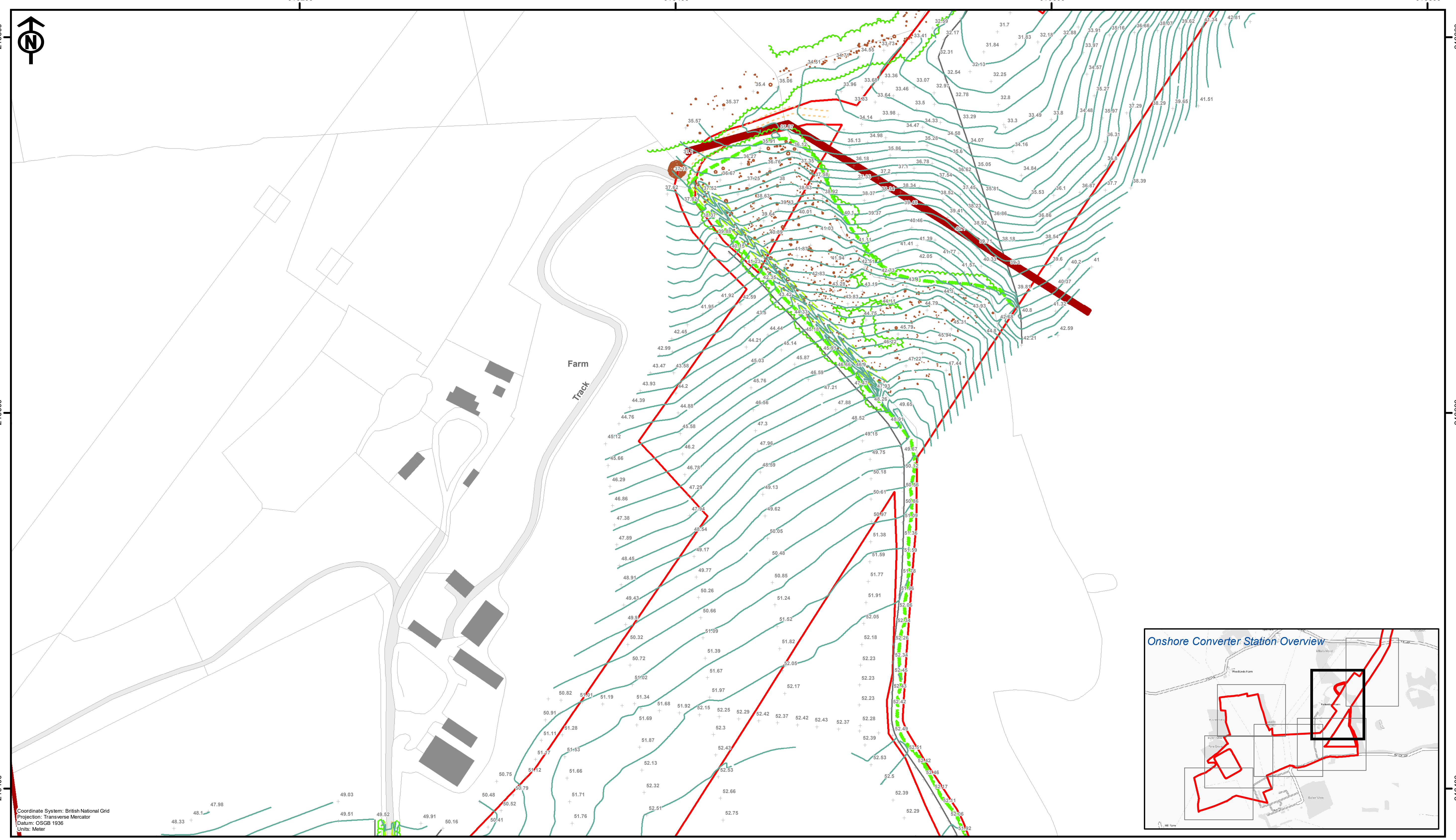
0 40 80 Metres

Onshore Converter Station Stage

Appendix: ONCS Topography

Drg No	05356.00006.12.0063.0 ONCS Topography
Rev	1
Date	24/01/2022
Layout	N/A

Document Path: \\gisfs1\G\Projects\05356 - GoBe Consultants Ltd\00006 East Anglia Three\Tech\GIS\Dwgs\Wking\EA3\Onshore Substation\Doc Ref EA3-GRD-CON-PLN-IBR-000107\ONCS\5356.00006.12.0073.0 Appendix Topology.mxd



- EA THREE DCO Corridor
- Overhead Telecom
- Hedge
- Structure
- Structure Overhead
- Tree
- Wall

Topographic Survey Legend

- Banking
- Tree Canopy
- Road Centreline
- Spot Height (m)
- Fence
- Vegetation Extent
- Contour Line
- Overhead Electicity
- Gate
- Surface Edge

GoBe consultants

Rev	Date	By	Comment
A	24/01/2022	PW	First Issue

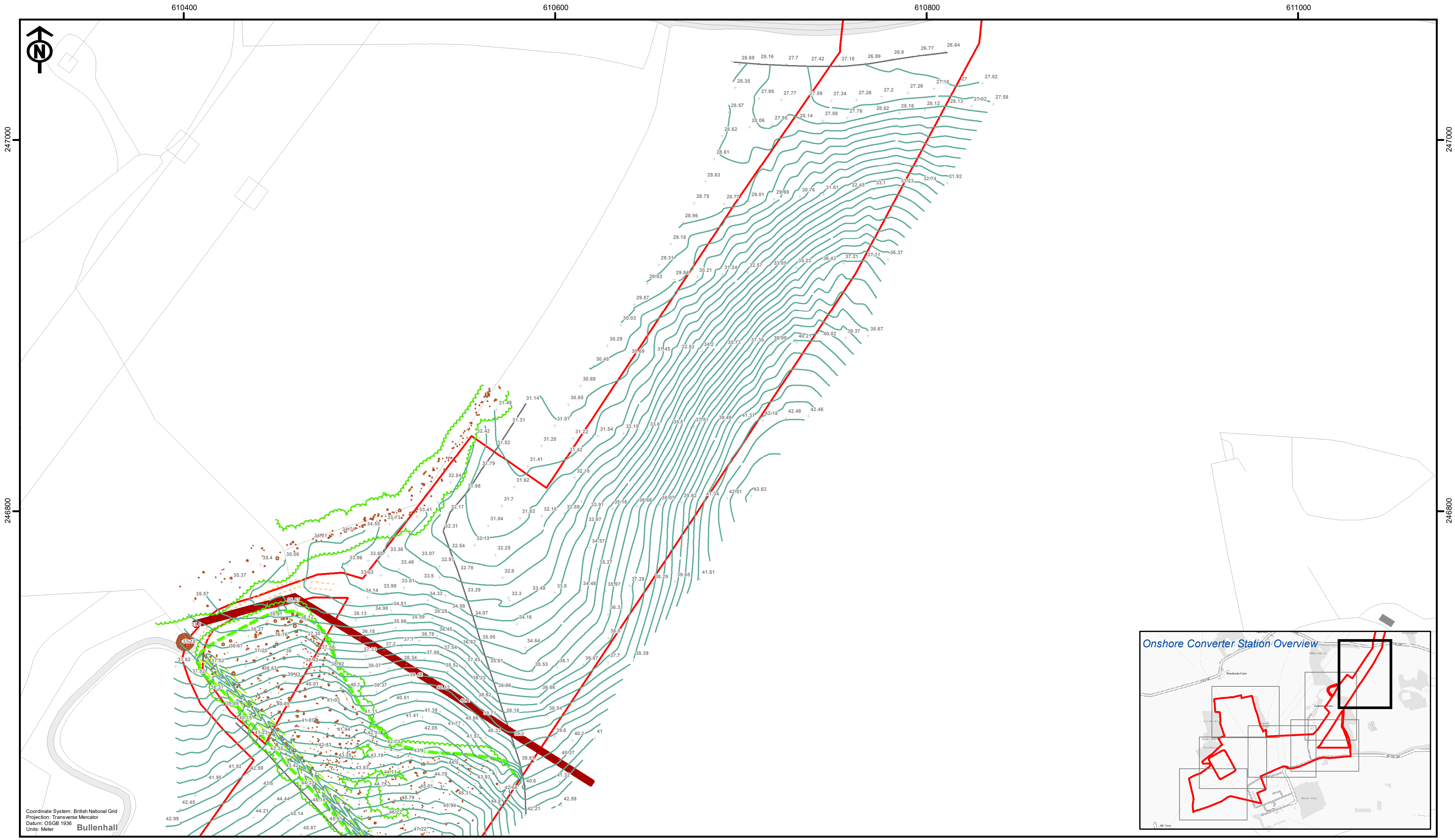
Original A3 Plot Scale 1:2,000

0 40 80 Metres

Onshore Converter Station Stage

Appendix: ONCS Topography

Drg No	05356.00006.12.0063.0 ONCS Topography
Rev	1
Date	24/01/2022
Layout	N/A



EA THREE DCO Corridor	Overhead Telecom	Hedge
	Structure Overhead	Tree
Topographic Survey Legend	Banking	Tree Canopy
Spot Height (m)	Fence	Vegetation Extent
Overhead Electicity	Gate	Surface Edge

Structure	Wall
Road Centreline	Contour Line

GoBe consultants

Rev	Date	By	Comment
A	24/01/2022	PW	First Issue

Original A3 Plot Scale 1:2,000

0 40 80 Metres

Onshore Converter Station Stage

Appendix: ONCS Topography

Drg No	05356.00006.12.0063.0 ONCS Topography
Rev	1
Date	24/01/2022
Layout	N/A

Document Path: \\gisfs1\G\Projects\05356 - GoBe Consultants Ltd\00006 East Anglia Three\Tech\GIS\Dwgs\Wking\EA3\Onshore Substation\Doc Ref EA3-GRD-CON-PLN-IBR-000107\ONCS\5356.00006.12.0073.0 Appendix Topology.mxd

APPENDIX 4 SURFACE WATER FEATURES: MAINTENANCE SCHEDULE

Indicative Schedule of Maintenance

1. The following is an indicative annual schedule of maintenance visits and the work that will be undertaken. This provides a reasonable frequency for the more common operations and a good indication of the required level of intensity of management required but is not intended to be either fully comprehensive or restrictive.

2. An appointed contractor will be required to construct a schedule of operations specifying the necessary operations and frequency, using his own experience and horticultural knowledge.

3. The ongoing wider programme of maintenance work will include proposed frequency of visits and operations detailed in the specification. It will also include scheduled dates for:

   - Infrequent operations such as re-spacing of plants, pruning, topping up of mulch, replacement of plants / restocking of beds etc.
   - Planting review and refurbishment.
   - Monitoring and review.
   - The effectiveness of the management operations is to be closely and continually monitored and reviewed annually against the NBS Specification and this Maintenance Plan, with any resulting changes incorporated into the subsequent years' programme.

4. The surface water SuDS feature will consist of a mixture of planted wetland and species rich grassland, grass swale areas along with the planting associated with the SuDs pond.

5. Proprietary equipment for flow control, such as stop valves, orifice plate outlet and hydro control and for pollution control, such as oil or glycol sensors, sensor steered pumps in the bunds underneath the transformers and the oil interceptor need to be regularly inspected, cleaned and maintained in accordance with the requirements given in the manufacturers' inspection and maintenance manuals but will be undertaken at least every six months.

6. The following tables summarise the proposed maintenance activities and the indicative number of visits.

Table 1: Wetland and Species Rich Grassland areas – Activities and Number of Visits

Month	Weeding	Mowing (leave arisings for 1 week)
January		
February		
March		1
April		
May	1	
June		
July		
August		
September	1	1
October		
November		
December		

Table 2: Swale Maintenance – Activities and General Frequency

Maintenance	Action	Frequency
Regular Maintenance	Litter and debris removal from site	Monthly
	Amenity grass cutting at 35-50mm	As required
	Grass cut to swales, access and overflows 75-100mm not to exceed 150mm	Monthly or as required
	Wetland or meadow vegetation cut at 50mm and remove to wildlife or compost piles	Monthly or as required
	Inspect and clear inlets, outlets and overflows	Monthly
Occasional tasks	Remove leaf accumulation	As required
	Cut back overhanging branches to allow dense vegetation growth	As required
Remedial work	Repair erosion, level uneven surfaces or damage by re-turfing or seeding	As required
	Remove silt and spread locally outside design profile and reinstate surface	As required
	Repair inlets, outlets or check dam structures to design detail	As required

Table 3: SuDS Pond Maintenance – Activities and General Frequency

Maintenance	Action	Frequency
Regular Maintenance	Litter and debris removal from site	Monthly
	Amenity grass cutting at 35-50mm	As required
	Grass cutting to access route, overflows and pond, where required, at 75-100mm not to exceed 150mm	As required
	Wetland and meadow grass, where appropriate, cut at 50mm and remove to wildlife or compost piles	Annually
	Cut pond vegetation if required and no more than 30% 100mm above pond base and remove to wildlife or compost piles	Annually or as required
	Manage wetland planting in micro-pools by cutting and remove to wildlife areas or compost piles	As required
	Inspect and clear inlets, outlets, control structures and overflows	Monthly
	Review silt accumulation remove and spread on site or remove from site, subject to agreement with the Environment Agency, if necessary	Annually

Maintenance	Action	Frequency
Occasional tasks	Remove leaf accumulation	Seasonal and as required
	Cut back overhanging branches to allow dense vegetation growth	As required
	Removal of tree or shrub growth within 5m of pond edge	As required
	Remove sediments from fore bay, inlets and pre-treatment structures Silts to be spread on site or removed from site, subject to agreement with EA	As required
Remedial work	Inspect and repair damage to inlets, outlets, banks and overflows	As required

Table 4: Open Watercourse/Ditch Maintenance – Activities and General Frequency

Maintenance Schedule	Required Action	Minimum Frequency
Regular Maintenance	Remove Litter and Debris.	Monthly, or as required
	Manage vegetation on banks and remove nuisance plants growing in channel.	Monthly at start, then as required
	Inspect outlets and outfalls entering the channel and culverts or crossings, and clear if required.	Monthly
	Inspect vegetation coverage on banks.	Monthly for 6 months, quarterly for 2 years, the half yearly
	Inspect channel bed for silt accumulation, and if appropriate establish appropriate silt removal frequencies.	Half yearly
Occasional tasks	Reseed areas of poor vegetation growth on banks, after plant types to better suit conditions, if required.	As required or if bare soil is exposed over 10% or more of the swale treatment area.
Remedial work	Repair erosion of banks by re-turfing or reseeding.	As required
	Repair scour or erosion at outfalls or structures and add additional scour protection	As required
	Remove build-up of sediment on channel bed.	As required

APPENDIX 5 HYDROGEOLOGICAL RISK ASSESSMENT

SCOTTISHPOWER RENEWABLES

Converter Station Stage

Hydrogeological Risk Assessment

Appendix 1 to the Surface and Foul Water Drainage Management Plan

(Applicable to Work Numbers 62 to 69)

Revision Summary				
Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**
1	19/01/2022	Stephen Muggeridge	Phil Rew-Williamson	Gareth Mills
2	19/04/22	Kay Griffin	Phil Rew-Williamson	Gareth Mills

Description of Revisions			
Rev	**Page**	**Section**	**Description**
1	ALL	ALL	New document
2	13-15 -	Section 6.1 Figures	Update to development details Minor amendments to site layouts

SCOTTISHPOWER RENEWABLES

TABLE OF CONTENTS

FIGURES

1. INTRODUCTION AND SCOPE

1.1. Project Overview

1. East Anglia Three Limited (EATL) was awarded a Development Consent Order (DCO) by the Secretary of State, Department of Business, Energy and Industrial Strategy (DBEIS) on 7 August 2017 for the East Anglia THREE Offshore Windfarm (EA THREE). The DCO granted consent for the development of a 1200MW offshore windfarm and associated infrastructure and is live until 28 August 2022. The DCO has now been subject to three non-material variations:

- In March 2019 EATL submitted a non-material change application to DBEIS to amend the consent to increase the maximum generating capacity from 1,200MW to 1,400MW and to limit the maximum number of gravity base foundations to 100. In June 2019 DBEIS authorised the proposed change application and issued an Amendments Order.
- In July 2020 EATL submitted a second non-material change application to DBEIS to amend the parameters of its offshore substations (reducing the number of these to one) and wind turbines (a decrease in the number of turbines and an increase in their hub height and rotor radius). On 15 April 2021 DBEIS authorised this proposed change application and issued an Amendments Order.
- In August 2021 EATL submitted a third non-material change application to DBEIS to amend the consent to remove the maximum generating capacity of 1,400MW and to amend the parameters of its wind turbines (a decrease in the number of turbines and an increase in their hub height and rotor radius). The application is currently in the consultation phase.

2. The onshore construction works associated with EA THREE will have a capacity of 1400MW and transmission connection of 1320MW. The construction works will be spread across a 37km corridor between the Suffolk coast at Bawdsey and the converter station at Bramford, passing the northern side of Ipswich. As a result of the strategic approach taken, the cables will be pulled through pre-installed ducts laid during the onshore works for East Anglia ONE Offshore Windfarm (EA ONE), thereby substantially reducing the impacts of connecting to the National Grid (NG) at the same location. The infrastructure to be installed for EA THREE, therefore, comprises:

- The landfall site with one associated transition bay location with two transition bays containing the connection between the offshore and onshore cables;
- Two onshore electrical cables (single core);
- Up to 62 jointing bay locations each with up to two jointing bays;
- One onshore converter station, adjacent to the EA ONE Substation;
- Three cables to link the converter station to the National Grid Bramford Substation;
- Up to three onshore fibre optic cables; and
- Landscaping and tree planting around the onshore converter station location.

1.2. Purpose and Scope

3. SLR Consulting Ltd (SLR) has been appointed by EATL to provide a Hydrogeological Risk Assessment (HRA) as part of the Converter Station Stage for the EA THREE onshore construction works. The works in this stage comprise Work No.s 62 to 69.

4. The Environment Agency (EA) have requested that an HRA is undertaken before works commence for any groundwater abstractions and groundwater dependent water features (e.g. ponds, springs) within 250m that are vulnerable to adverse impacts in terms of both levels and water quality. In addition, it is noted that the draft pre-commencement requirements for EA ONE North and EA TWO Offshore Windfarms have requested that an HRA is completed prior to commencement of any construction activity that could cause changes to aquifer flow or affect water quality within 500m of any groundwater dependent habitats within ecological sites.

5. An initial scoping exercise has therefore been completed based on these same search radii on the Converter Station Stage site, as presented on Figures 4 and 5. These present the locations of all ecological sites within a 500m radius of the site and groundwater abstractions and groundwater source protection zones within a 250m radius. The figures indicate that the site is located within groundwater Source Protection Zone 3 (Total Catchment) with the eastern end of the Haul Road extending into Zone 2 (Outer Protection Zone).

6. A description of the construction activities associated with the Converter Station Stage is included within Section 6.1 and is shown in Appendix 1.

7. This Hydrogeological Risk Assessment has been prepared as an appendix to the Surface and Foul Water Drainage Management Plan for the Converter Station Stage and includes a desktop review of the site's baseline geology, hydrogeology and hydrology in order to develop a conceptual site model (CSM). This CSM is then used to assess the potential impact of the works on identified hydrogeological or hydrological receptors and to outline any mitigation which will be required to ensure the works do not adversely impact identified receptors.

2. ABBREVIATIONS

BEIS	Business, Energy and Industrial Strategy
BGS	British Geological Survey
CEMP	Contractor Environmental Management Plan
CSM	Conceptual Site Model
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EA THREE	East Anglia Three Offshore Windfarm
EATL	East Anglia Three Limited
GPP	Guidance for Pollution Prevention
HRA	Hydrogeological Risk Assessment
HIA	Hydrogeological Impact Assessment
mAOD	Metres above ordnance datum
mbgl	Metres below ground level
MSDC	Mid Suffolk District Council
NG	National Grid
NGR	National Grid Reference
PPG	Pollution Prevention Guidance
SCC	Suffolk County Council
SPZ	Groundwater Source Protection Zone
SuDs	Sustainable drainage system

3. METHODOLOGY

8. This HRA has been developed in accordance with relevant Environment Agency (EA) guidance on completion of groundwater risk assessments[1] and Hydrogeological Impact Appraisals (HIA)[2] and includes the following stages:

- Section 5 provides a baseline assessment of the site. This includes a summary of the site geology and hydrogeology including information on ground conditions, groundwater levels and flows, groundwater quality and the location of potential receptors which could be impacted as a result of construction activities at the site. Finally, a CSM of the current hydrogeological regime is provided.

[1] Available from Groundwater risk assessment for your environmental permit - GOV.UK (www.gov.uk) [Accessed November 2021]
[2] Environment Agency (April 2007) *Hydrogeological Impact Appraisal for Dewatering Abstractions*, Science Report – SC040020/SR1

- Section 6 provides an assessment of the potential impact that the works could have upon the identified receptors and regional hydrogeology and hydrology. Appropriate mitigation measures are outlined where required.
- Section 7 provides a summary of the overall impact that the works could have upon the local hydrogeology and any identified receptors.

9. A qualitative risk assessment methodology has been used to assess the potential significance of impact associated with the development works. Two factors are considered using this approach: the sensitivity of the receiving environment; and magnitude of any potential impact. This approach provides a mechanism for identifying where additional mitigation measures are potentially required to reduce the risk to groundwater or surface water receptors.

4. SOURCES OF INFORMATION

10. The following sources of information have been consulted to characterise the geology, hydrogeology and hydrology of the area within and surrounding the application site:

- British Geological Survey (BGS) online maps (https://www.bgs.ac.uk/map-viewers/geoindex-onshore/) for details of geology and borehole logs;
- Hydrogeological map of Southern East Anglia, sourced from the BGS website (https://largeimages.bgs.ac.uk/iip/hydromaps.html?id=southern-east-anglia.jp2);
- National Soils Resource Institute Website for details on soils (https://www.landis.org.uk/soilscapes/);
- Defra Magic Map Website (https://magic.defra.gov.uk/) for details on groundwater classifications, source protection zones and groundwater and surface water dependent designated ecological sites;
- Groundwater and surface water quality and status as presented in the EA catchment planning datasets (https://environment.data.gov.uk/catchment-planning/); and
- Details of the site layout, development, and other site details.

5. CONCEPTUAL SITE MODEL

11. The geological and hydrogeological regime of the Converter Station Stage site and the surrounding area is considered under the following headings: location and topography; geological setting; and hydrogeological setting, all of which have been used to develop a CSM.

5.1. Location and Topography

12. The site, centred on (NGR) TM 09772 46242, which is immediately to the east of the EA ONE Substation and to the north of the existing NG Bramford Substation.

13. The site presently comprises extensive areas of arable land, bordering woodland to northwest, and including limited woodland within its north-eastern area.

14. The temporary laydown area for the construction of the EA ONE substation (within Work No, 67) was covered in hardstanding, of which will be removed prior to the start of the construction works for the Converter Station.

15. The ground elevation ranges from approximately 45m to 57m AOD and crosses a minor ridgeline. On-site ground levels are highest along the boundary with the NG Bramford Substation. Land elevations from this high point fall gradually to the south-west, which is offsite, and to the north-northeast onsite respectively.

16. The layout of the construction works is provided as Appendix 1.

5.2. Geology

5.2.1. Soil, Superficial Deposits and Bedrock Geology

17. The Cranfield Soilscapes online soil map viewer indicates that 'slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils' extend throughout the middle section of the site from the northwest, with 'lime-rich loamy and clayey soils with impeded drainage' forming the rest of the site and the majority of the surrounding area.

18. BGS historic borehole logs, as presented in Appendix 2, indicate topsoil in the area is typically in the region of 0.5m thick.

5.2.2. Superficial Geology

19. A geological map showing the regional superficial geology as plotted on the BGS online mapping service Geoindex Onshore is provided as Figure 1. This includes the locations of nearby BGS boreholes used to analyse ground conditions and locations of licensed and private abstractions.

20. The BGS online mapping service Geoindex Onshore indicates that the site is wholly underlain by Diamicton of the Lowestoft Formation. BGS mapping indicates these Diamicton deposits are laterally extensive.

21. The Lowestoft Formation forms an extensive sheet of chalky till, together with outwash sands and gravels, silts and clays. Diamicton is sediment resulting from dry-land erosion that is unsorted to poorly sorted and contains particles ranging in size, suspended in a matrix of mud or sand.

22. There are further Lowestoft Formation, River Terrace and Kesgrave catchment sand and gravel deposits in the region and alluvium, which is predominantly composed of clay and silt, in vicinity of rivers and streams. However, these superficial deposits are not indicated to be in close proximity to the site.

23. Historic borehole logs compiled from the BGS Geoindex website indicate that clayey superficial deposits are at least 10m thick in the local area.

5.2.3. Bedrock Geology

24. Bedrock geology, based on BGS Geoindex mapping, is provided in map format in Figure 2.

25. BGS Geoindex mapping indicates that clays, silts and sand of the Thanet Formation and Lambeth Group underly the majority of the site, with an outcrop of sand associated with the Red Crag Formation overlying the Thanet Formation in the north site and the Thames Group (clays, silts and sands) overlying the Thanet Formation along the southern boundary.

26. BGS borehole logs (see Appendix 2) also indicate the clays and silts typical of the Woolwich and Reading beds, which are sub-units of the Lambeth Group and are primary bedrock deposits in the local area. Sand and gravels associated with the Red Crag Formation have been proven north of the site.

27. The Newhaven Chalk Formation is shown by BGS mapping to extend extensively northwards from the area north of the site. This Chalk Formation is typically described as '*soft to medium hard, smooth white chalks with numerous marl seams and flint bands, including abundant Zoophycos flints'* and is typically 45m to 75m in thickness. The chalk is present at depth beneath the Thanet Formation and Lambeth Group deposits.

28. Nearby BGS logs have proven the depth from ground level to chalk to be over 20m at a minimum and the chalk to be in excess of 50m in thickness locally.

5.3. Hydrogeology

5.3.1. Recharge Mechanisms

29. The Met Office climate summary (1991 – 2010) for Wattisham (52.123, 0.961), located c.8km northwest of the site, indicates that the average annual rainfall for the site is 614mm.

30. Climate averages for Wattisham are provided in Table 5-1.

Table 5-1 Met Office Climate Averages for Wattisham (1991 – 2010)

Month	Max. Temp. (°C)	Min. Temp (°C)	Rainfall (mm)	Days of Rainfall ≥ 1mm
January	6.57	1.01	49.19	11.22
February	6.84	0.82	40.65	9.47
March	9.82	2.55	44.35	10.4
April	12.71	4.11	41.1	9.33
May	16.16	7.17	50.94	8.73
June	19.11	9.89	52.59	9.1
July	21.86	12.16	50.1	8.73
August	21.81	12.17	56.23	8.43
September	18.57	10.2	51.88	8.83
October	14.24	7.48	64.82	10.07
November	9.73	3.87	59.93	10.87
December	6.86	1.56	51.95	10.61
Annual	13.73	6.11	613.73	115.79

31. Recharge regionally will be variable depending upon the localised superficial geology. As Diamicton is present across the site, on-site recharge will potentially be limited by the often-clayey nature of the deposits.

5.3.2. Aquifer Characteristics and Groundwater Vulnerability

32. The aquifer characteristics and EA aquifer designation of the strata within the immediate vicinity of the works are summarised in Table 5-2.

Table 5-2 Aquifer Designations

Deposit Type	Formation	Aquifer Designation
Superficial	Lowestoft Formation (Diamicton)	Secondary (Undifferentiated)
Bedrock	Thames Group	Unproductive
	Thanet Formation and Lambeth Group	Secondary A
	Red Crag Formation	Principal
	Newhaven Chalk	

33. The various classifications are described by the EA as follows:

- Principal Aquifer: *layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.*
- Secondary A Aquifer: *permeable layers that can support local water supplies, and may form an important source of base flow to rivers.*
- Secondary B Aquifer: *lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin fissures and opening or eroded layers.*
- Secondary (undifferentiated): *where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value.*
- Unproductive Strata: *strata that are largely unable to provide usable water supplies and are unlikely to have surface water and wetlands ecosystems dependent on them.*

34. Diamicton of significant thickness underlies the entire site. These deposits will potentially be variable with some groundwater flow possible within sand and gravel horizons, however the typically clayey nature of the deposits make it unlikely that the deposits will provide significant groundwater supply or baseflow to watercourses.

35. The Newhaven Chalk Formation is classified as a principal aquifer and provides significant abstractions for potable water. It also provides significant baseflow to watercourses. As it is overlain by significant Diamicton and Thanet Formation and Lambeth group deposits across the entire site, as well as Thames Group deposits in the south, it is considered that there is no direct hydraulic connection between the site and Chalk.

36. The Thanet Formation and Lambeth Group deposits are classified as a Secondary A aquifer. Groundwater flow within these deposits will be laterally variable and primarily within and sandstone horizons.

37. The sands and gravels associated with the Red Crag Formation may be in continuity with the Chalk but again are overlain by thick lower permeability Diamicton deposits and are limited in lateral extent.

5.3.3. Groundwater Levels and Flow

38. An extract from the 1981 Hydrogeological map of Southern East Anglia, sourced from the BGS website and presented as Figure 3 indicates that the potentiometric surface of groundwater within the Chalk underlying the site is typically in the region of 10mAOD.

39. Groundwater flow within the Chalk is predominantly in an easterly / south-easterly direction and being influenced by the valley of the River Gipping, suggesting that groundwater is in continuity with this river.

40. Groundwater levels within historic BGS boreholes confirms the aforementioned hydrogeological mapping, with groundwater encountered within the Chalk typically measured at between 7 and 12mAOD within the immediate proximity of the site.

41. Shallower perched groundwater has also been recorded within the Woolwich and Reading Beds at c.20mAOD. This is likely to be associated with a sandy horizon within these deposits but appears to be perched above the regional groundwater table in the Chalk which is considered the principal aquifer for abstractions regionally.

42. As outlined in Section 5.1, ground elevations range between c.45mAOD to 57mAOD, indicating that the depth to groundwater within the chalk is likely to be in the region of 35 to 50mbgl. Depths to perched groundwater within the Thanet Formation and Lambeth Group are also 25-40m below ground level.

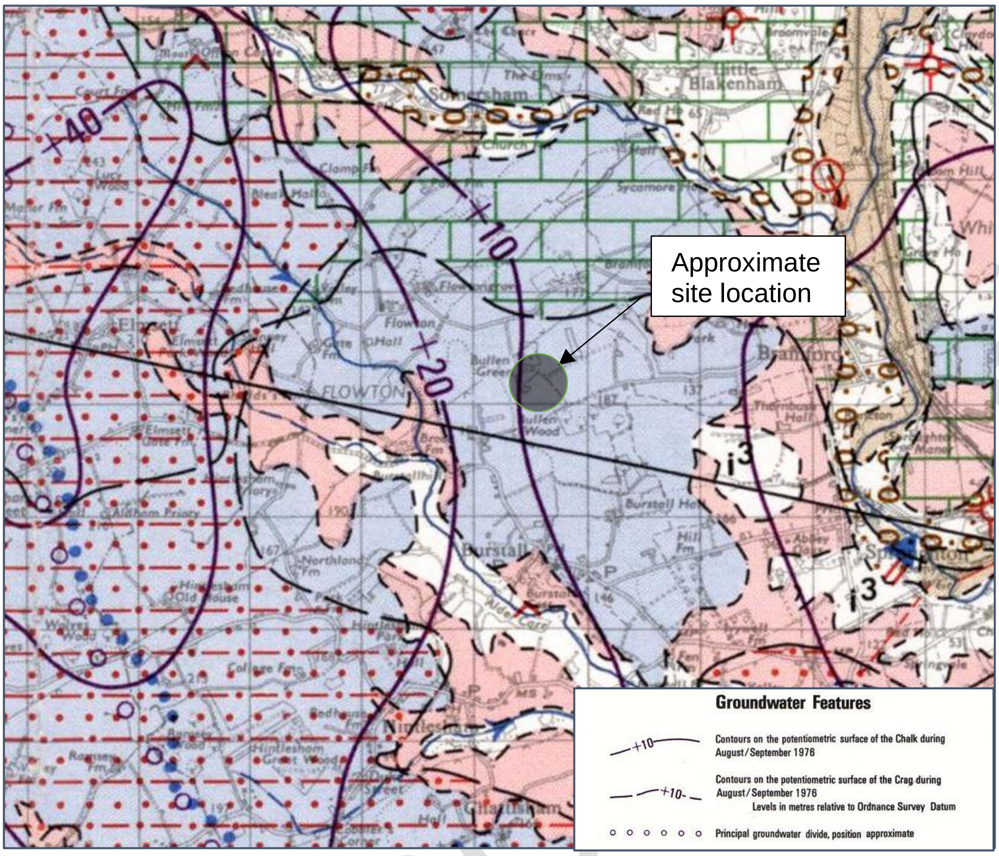


Figure 3 Extract from Regional Hydrogeological Mapping

43. Due to the low permeability of drift deposits underlying the site, any groundwater flow regimes within these deposits are likely to be in limited hydraulic continuity with regionally important aquifers.

5.3.4. Groundwater Abstractions and Source Protection Zones

44. Defra's Magic Map website indicates the site is wholly within Zone III of a Groundwater Source Protection Zone (SPZ) which extends across the extent of the Chalk aquifer. Zone II of the SPZ is found in close proximity to the north-eastern corner of the site and the eastern end of the haul road in Work No. 62 extends into the zone II SPZ. The SPZs are included on Figure 4.

45. Groundwater SPZ are designated as follows:

- Inner – SPZ Zone I
- Outer – SPZ Zone II
- Total catchment – SPZ Zone III

46. There are no licensed or private surface water or groundwater abstractions within the site boundary or within a 500m radius of the site.

47. Details of a potential licensed abstraction approximately 600m north of the site are provided as Table 5-3**.**

Table 5-3 Licensed Abstraction Details

License No.	Use	NGR	Likely Source Type and Unit
7/35/08/*G/0190A	Potable Water Supply - Direct	TM11204698	Groundwater from Chalk

5.3.5. Groundwater Quality

48. With reference to Environment Agency catchment planning and assessments, the site is located within the Waveney and East Suffolk Chalk & Crag Water Body[3]. This catchment is 1,455km^2 in area.

49. The most recent assessment in 2019 determined that the catchment has 'poor overall status' due to a 'poor' overall quality and quantity status. A list of individual parameters of recent Waveney and East Suffolk Chalk & Crag Water Body classification criteria is presented in Appendix 3. Pollution from poor livestock management is indicated as a source of contaminants.

5.3.6. Hydrology

50. The majority of the site is located within the catchment of the River Gipping, an EA main river situated approximately 2.2km east of the site at its closest. As outlined in section 5.3.3, this watercourse is considered to be in continuity with the regional chalk groundwater which provides baseflow to the river.

51. The west of the site is within the catchment of the Belstead Brook, which is situated approximately 700m west of the site at its closest and has a catchment area of c.50km^2. The Belstead Brook, which is considered as a 'Main River' by the EA runs in a south-easterly direction and ultimately discharges to the River Orwell c.7.5km southeast of the site.

52. There are limited surface water features present within the site boundary. There is a SuDS detention basin located close to the existing access and a modified 'wet woodland' basin located to the south of the EAONE Substation which will permanently retain a pool of water (Scottish Power Renewables, 2016). These are part of the EA ONE storm water drainage systems.

53. There are two ordinary watercourses (open channels) in the central-east portion of the site, with one feeding to the west of the site following the southwest site boundary. These are field drains that are typically dry but during wet periods convey storm flows. One of these contributes to an extensive surface water flow pathway extending east away from the site. As the southern part of the site is at an elevation of around 57mAOD with levels then falling away to the north, east and south minor channels and water features are likely features of the downslopes within the site's moderately undulating terrain.

54. There are several ordinary watercourses located within proximity to the site. Based on Ordnance Survey mapping the closest of these to the Converter Station site are;

a. A field drain that rises at NGR 609710, 245310 around 500m to the south of the site flowing southwards into Belstead Brook.

b. Field drain that rises at NGR 610973, 246200 around 400m to the east of the site, flowing eastwards towards the River Gipping.

c. Field drain that rises at NGR 611044, 245742 around 510m to the southeast of the site along Bullen Lane, flowing eastwards towards the River Gipping.

d. A field drain that rises at NGR 608637, 247159 and is located 650m from the north of the site at its closest point flowing towards Somersham.

[3] Environment Agency (n.d.) Catchment Data Explorer. [online] Available at: https://environment.data.gov.uk/catchment-planning/ [Accessed November 2021]

All of these features are relatively shallow and given the generally low productivity of the superficial and near surface bedrock deposits are considered unlikely to be groundwater fed and are therefore not considered a potential receptor.

5.3.7. Surface Water Quality

55. With reference to EA catchment planning and assessments, the site is predominately located within the Gipping (d/s Stowmarket) Water Body catchment. This catchment is 97.2km^2 in area, relates to a river water body and extends between Stowmarket and Ipswich. The catchment has a heavily modified hydromorphological designation.

56. The most recent assessment in 2019 determined that the catchment has 'Poor Ecological Status' and also a chemical status of 'Fail'. A list of individual parameters of recent Gipping (d/s Stowmarket) Water Body classification criteria is presented in Appendix 4. The priority hazardous substances of Mercury, Perfluorooctane Sulphonate and Polybrominated Diphenyl Ethers were recorded as failures with respect to 2019 water quality assessments. A range of specific pollutants were also recorded as 'High': Chlorothalonil; Chromium (VI); Copper; Iron; Pendimethalin; and Zinc. Physico-Chemical quality was assessed as 'Moderate' overall, with Acid Neutralising Capacity, Ammonia and pH recorded as 'High' and Dissolved Oxygen and Phosphate as 'Poor'.

57. The western part of the site is within the catchment of Belstead Brook Water Body Catchment. The most recent assessment in 2019 determined that this catchment also has 'Poor Ecological Status' and a chemical status of 'Fail'. A list of individual parameters of recent Gipping (d/s Stowmarket) Water Body classification criteria is presented in Appendix 4. The priority hazardous substances of Mercury and Polybrominated Diphenyl Ethers were recorded as failures with respect to 2019 water quality assessments. Physico-Chemical quality was assessed as 'Moderate' overall, with Dissolved Oxygen as and pH recorded as 'High' and Phosphate as 'Moderate'.

5.3.8. Water-Dependent Ecological Sites

58. A review of the Natural England Magic Map webpage indicates that there are no water dependent ecological sites within a 2km radius of the site.

5.4. Conceptual Site Model

59. The assessment of the baseline conditions of the site indicates that the site is underlain by low permeability deposits of Diamicton which are locally up to 10m in thickness. There are no known water abstractions or springs within or in close proximity to the site boundary.

60. An extensive Chalk aquifer is found at depth underlying the site, with groundwater within this principal aquifer likely in the region of 35 to 50mgbl. However, as the site is within Zone III of a Groundwater Source Protection Zone, and with Zone II in close proximity to the northern boundary, groundwater is considered as a potential receptor.

61. Water quality assessments indicates that the surrounding groundwater and surface water quality is poor.

62. There are no water dependent ecological sites within a 2km radius of the site that are considered to be in hydraulic continuity with the site.

6. HYDROGEOLOGICAL & HYDROLOGICAL IMPACT ASSESSMENT

6.1. Development

63. As shown on the plan in Appendix 1, the converter station works comprise a stage of the onshore connection works and covers work No.s 62 to 69 and will comprise the following phases of works.

6.1.1. Enabling Works

64. The onshore construction works will commence with the enabling works, which comprises the establishment of the temporary laydown area (Work No 65) and the access to this from the existing EA ONE access road. The temporary laydown area will be directly northeast of the converter station and will include temporary offices, welfare, car parking, materials and equipment storage. At the

start of the works the onshore converter station compound and temporary laydown area will be temporarily fenced in accordance with the Fencing and Enclosures Plan (EA3-GRD-CON-PLN-IBR-000106) and a security cabin will be installed at the main access gate.

65. Following any necessary ecological mitigation, topsoil will be stripped from the access road and temporary laydown area and stored at specific storage locations as to avoid cross contamination with other materials. Topsoil storage and management will be compliant with the recommendations and requirements set out in the Onshore Converter Station Landscape Management Plan (EA3- EA3-GRD-CON-PLN-IBR-000103). Topsoil will be stored to one side of the working area, in such a way that it is not mixed with any subsoil. Typically this would be stored as an earth bund of a maximum height of two metres, to avoid compaction from the weight of the soil. Storage time will be kept to a minimum, to prevent the soil deteriorating in quality and the topsoil bunds seeded to prevent windblow. Topsoil stripped from different fields will be stored separately, as would soil from specific hedgerow banks or woodland strips.

66. The construction of an access road typically involves the placement of suitable graded imported stone material onto a suitable subgrade, potentially with a reinforcing geogrid and/or a geotextile, however other methods such as soil stabilisation may be used if considered appropriate. Following the initial topsoil stripping, the on-site access road will be installed for a width of 6m.

67. The enabling works will also include installation of surface water drainage for the access road and temporary laydown area, in accordance with the Surface Water and Drainage Management Plan (EA3-GRD-CON-PLN-IBR-000107). Foul water drainage during this initial period will be via portable welfare facilities, with a tank that will be emptied on a weekly or bi-weekly basis.

6.1.2. Construction

68. The EA THREE onshore converter station will be located within a fenced compound (maximum 157m by 186m) (Work No. 67), immediately to the east of the East Anglia ONE Substation and to the north of the existing NG Bramford Substation. The converter station will contain electrical equipment including power transformers, switchgear, reactive compensation equipment, harmonic filters, cables, lightning protection masts, control buildings, communications masts, backup generators, access, fencing and other associated equipment, structures or buildings. The converter station will have a compact layout, with the majority of the equipment contained in buildings not incongruous to their setting.

69. The construction of the converter station will comprise a number of key stages, including: platform upfill to finished level (approx. 54m AOD) foundations and building construction and equipment installation and commissioning.

70. The main site access has already been constructed as part of the EA ONE works, however, an internal service road from this will require installation.

71. The enabling works will include grading and earthworks to remove any unsuitable materials from the converter station area and to build up with suitable fill material to establish a formation level for the converter station construction. The materials excavated will be reused on site as engineering fill or landscaping depending on material properties.

72. Following the completion of the site grading, works will commence with the excavations for ducting and the foundations for the buildings and external plant. The building will largely comprise steel, concrete or masonry and cladding materials. The structural steelwork will be fabricated and prepared off site and delivered to site for erection activities using cranes. The composite or cassette cladding panels (e.g. Kingspan) will be delivered to site ready to erect and be fixed to the steelwork.

73. The civil works will be followed by the installation and commissioning of the electrical equipment. The large transformers will be filled on site. The smaller electrical components will be constructed on site using small mobile plant and lifting apparatus.

6.1.3. Cable Installation

74. Works No.s 63 and 66 will comprise the installation in open trenches of cables to connect the Converter Station to the nearby National Grid Bramford Substation. Construction activities for the installation of the cable in open trenches will be undertaken within a temporarily fenced strip of land, referred to as the working width.

75. The cable route into the Converter Station from Work No. 64 through Work No 63 was not known at the time of the preparation of the Environmental Statement and it was considered at that time that this may also be installed using open trenches. The ducts have

now, however, been installed during the construction works for EA ONE to end within Work No. 67 (the converter station site). There will, therefore, be no requirement, as originally anticipated, to open trench these through Work no. 63 to the Converter Station.

76. Works in Work No. 62 will also include the installation of haul road to reach a jointing bay in the adjacent Work No. 58 (not part of this stage) to the east. This will follow the route of the EA ONE haul road as shown in Figure 2.

77. In addition, all ducts to be used for EA THREE, which were installed during the EA ONE construction works, will require to be 'proved' to ensure that they are intact and free of debris. This will generally be undertaken by the use of foam pigs driven under pressure from jointing bay to jointing bay. Each stretch of duct that was installed using HDD will, however, require duct-proving excavations at each end to allow the use of different diameter foam pigs, due to a difference in the diameter of these compared to the ducting installed using open trench techniques.

6.2. Assessment of Impact

78. The potential impact of the Converter Station Works on groundwater and surface water receptors are outlined in Section 6.2.1, using qualitative risk assessment methodology based on the sensitivity of the receptor and likelihood of impact occurring. Impacts assessed as moderate or high are considered to require further mitigation.

6.2.1. Potential Effects

79. Without appropriate design and controls, construction of the Converter Station works has the potential to impair local hydrology (water quality) and hydrogeology (groundwater levels, flow and quality), such as:

- The use of machinery and the movement of soils has the potential to generate suspended solids in run-off and/or introduce oils or hydrocarbons to the water environment;
- Existing groundwater flow paths could be disturbed or altered, impacting on nearby groundwater abstractions.

Standard construction techniques and best practices are to be used to avoid or reduce these potential impacts. Details are given in the following section.

6.2.2. Embedded Mitigation

80. Best practice construction techniques and procedures that have been developed through a series of management plans for approval by the Environment Agency, Mid Suffolk District Council (MSDC) and Suffolk County Council (SCC), in accordance with the requirements of the DCO. These include:

- Converter Station Stage Surface Water and Drainage Management Plan (EA3-GRD-CON-PLN-IBR-000107)
- Converter Station Stage Code of Construction Practice (EA3-GRD-CON-PLN-IBR-000110) including:
  - Pollution Prevention and Emergency Incident Response Plan; and
  - Project Environmental Management Plan.

81. The construction works will also be undertaken in accordance with good practice guidance within the following documents:

- CIRIA SP156 Control of Water Pollution from Construction Sites - Guide to Good Practice, 2002;
- CIRIA C741 Environmental Good Practice on Site Guide, 2015.

82. The Pollution Prevention Guidelines (PPGs) (which are progressively being replaced with Guidance for Pollution Prevention (GPPs)) provide environmental good practice for the whole of the UK and relevant PPGs/GPPs will be followed, including:

- GPP01: Understanding your environmental responsibilities – good environmental practices (Oct 2020);
- GPP02: Above Ground Oil Storage Tanks (Jan 2018);
- GPP04: Treatment and Disposal of wastewater where there is no connection to the public foul sewer (Nov 2017);
- GPP05: Works and maintenance in or near water (Feb 2018)
- PPG6: Working at construction and demolition sites (2012);

- GPP08: Safe storage and disposal of used oils (Jul 2017);
- GPP13: Vehicle Washing and Cleansing (Apr 2017);
- PPG18: Managing fire water and major spillages (Jun 2000);
- GPP21: Pollution incident response planning (Jun 2021);
- GPP22: Dealing with Spills (Oct 2018).

6.2.3. Impact upon Groundwater Levels and Flow Regimes

83. The works will only require shallow excavations and will primarily comprise of soil stripping and shallow foundations for constructions. Given that the depth to groundwater within the higher permeability Chalk is estimated at between 35m and 50m and the presence of 10m+ of low permeability Diamicton present beneath the Site there will be no requirement for dewatering and the works will not affect groundwater flow paths. The potential impact of the works on groundwater levels and flows is therefore assessed as '**negligible**'**.**

6.2.4. Impact upon Surface Water Flow Regime

84. It is considered that the works will not alter the wider surface water drainage regime and as the works will not impact groundwater levels or flow there will also be no impact on surface water flows. The potential impact on surface water flow is therefore assessed as **'negligible'**.

6.2.5. Impact upon Groundwater and Surface Water Quality

85. The activities at the site will inevitably give rise to suspended solids which if not managed could pollute surface waters and groundwaters. The work at the site will also involve the use of mobile plant which could give rise to fuel spills which could potentially contaminate surface waters and groundwaters.

86. Enabling and construction works will be undertaken in accordance with the management plans outlined in Section 6.2.2 which provide details of how construction will be completed in an environmentally safe manner and minimise the potential for spillages.

87. Best practice techniques will be incorporated within the management procedures for construction activities onsite in order to protect the water environment from pollution incidents. Key mitigation measures, as set out in the management plans, can be summarised as follows:

- during operation there will be heavy machinery required onsite and, as a result, it is appropriate to adopt best working practices and measures to protect the water environment, including those set out in the EA's Guidance for Pollution Prevention (GPP1);
- in accordance with GPP2 all above ground onsite fuel and chemical storage will be bunded;
- an emergency spill response kit will be maintained onsite;
- a vehicle management system will be put in place wherever necessary to reduce the potential conflicts between vehicles and thereby reduce the risk of collision;
- a speed limit will be imposed on site to reduce the likelihood and significance of any collisions;
- in accordance with GPP05 the amount of time stripped ground and soil stockpiles being exposed will be minimised and vegetation will only be removed from the area that needs to be exposed in the near future.
- plant and wheel washing will be carried out in a designated area of hard standing at least 10 metres from any watercourse or surface water drain or rock outcrop (hard rock at surface).

88. Given the embedded mitigation in place, the potential risk to groundwater quality, and subsequently surface water quality of any down-stream watercourses in hydraulic continuity with the Chalk is assessed as **'negligible'** to **'low'**. No additional mitigation above that outlined is considered necessary.

89. This potential risk rating applies also to the outer (Zone II) and inner (Zone I) Groundwater Source Protection Zones found in close proximity to the north-eastern border of the site.

6.2.6. Groundwater & Surface Water Quality During Active Phase

90. The converter station will be a permanent structure, this will be constructed on a concrete pad and any oils or other lubricants used within the converter station will either be stored within an appropriately bunded area. The risk of spillages is considered to be very low.

91. In the unlikely event of a spillage occurring the risk to groundwater receptors is considered to be **'negligible'** due to the extensive thickness of low permeability superficial deposits separating the site from the regional groundwater.

6.2.7. Impact upon Ecological Sites

92. As outlined within Section 5.3.8, there are no designated ecological sites which could be considered a potential receptor.

7. CONCLUSION

93. A hydrogeological and hydrological impact assessment has been undertaken to assess the potential impact upon the local hydrogeological and hydrological regime of the Converter Station Stage.

94. The assessment has identified no water abstractions or springs within 250m radius of the site which could act as a potential receptor for any adverse impact from the works.

95. As the site is within Zone III of a Groundwater SPZ, it is considered that groundwater is a potential receptor. However, groundwater within the Chalk underlying the site is expected to be 35 to 50m below current ground levels and overlain by low permeability deposits.

96. There is the potential that perched water is present in the underlying Thanet Formation and Lambeth Group deposits but this is unlikely to be of sufficient permeability to comprise a significant receptor, in addition this is also underlain by in excess of 10m of low permeability Diamicton which will act as a barrier to any spillages or leakages impacting groundwater quality.

97. An assessment of the potential impact of the works on groundwater levels, groundwater quality, surface water flows and surface water quality has been undertaken. The assessment indicates that as the works involve only shallow excavations, well above the regional groundwater table, the potential impact on groundwater levels and flow is negligible. The works will be undertaken in accordance with relevant management plans which will have been agreed with the EA, SCC and MSDC and with appropriate best practice, this embedded mitigation will ensure that there is no adverse impact on groundwater quality and in turn no impact on surface water quality.

8. REFERENCES

British Geological Survey. (n.d.) *GeoIndex (onshore)*. [online] Available at: https://www.bgs.ac.uk/map-viewers/Geoindex-onshore/ [Accessed 23 Nov. 2021].

CIRIA (2002) *Control of Water Pollution from Construction Sites: Guide to Good Practice*.

CIRIA (2015) *Environmental Good Practice on Site C741.*

Department of Environment, Food and Rural Affairs (n.d.) *MAGIC Map*. [online] Available at: https://magic.defra.gov.uk/ [Accessed 23 Nov. 2021].

Environment Agency (2007) *Hydrogeological impact appraisal for dewatering abstractions.* [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291080/scho0407bmae-e-e.pdf [Accessed 23 Nov. 2021].

Environment Agency (n.d.) *Catchment Data Explorer*. [online] Available at: https://environment.data.gov.uk/catchment-planning/ [Accessed 23 Nov. 2021].

Environment Agency (n.d.) *Water Resources: Help for License Trading - ArcGIS Web Application*. [online] Available at: https://www.arcgis.com/apps/webappviewer/index.html?id=c9176c299b734cff9a6deffcf7f40a4e [Accessed 23 Nov. 2021].

Institute of Geological Sciences. (1981*) Hydrogeological map of Southern East Anglia*. [online] Available at: https://largeimages.bgs.ac.uk/iip/hydromaps.html?id=southern-east-anglia.jp2/ [Accessed 23 Nov. 2021].

Met Office (n.d) *UK Climate Averages*. [online] Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages [Accessed 23 Nov. 2021].

National Soil Resources Institute. Cranfield University (n.d.) *Soilscapes Soil Types Viewer* [online] Available at: https://www.landis.org.uk/soilscapes/ [Accessed 23 Nov. 2021].

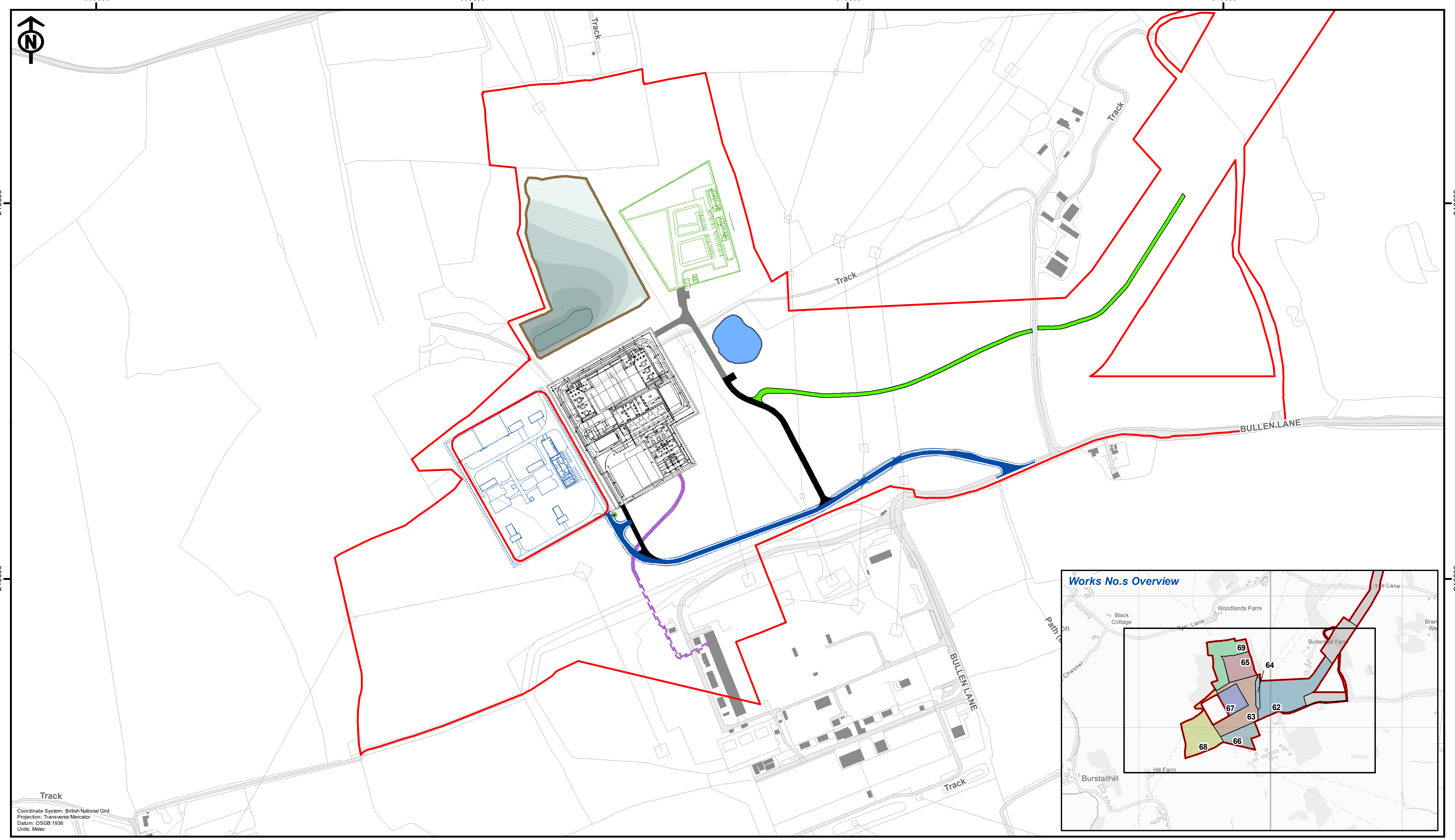
NetRegs (n.d.) *Guidance for Pollution Prevention (GPPs).* [online] Available at: https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/ [Accessed 23 Nov. 021].

UK Government (Last updated 2 May 2019) *Pollution prevention for businesses.* [online] GOV.UK. Available at: https://www.gov.uk/guidance/pollution-prevention-for-businesses/ [Accessed 23 Nov. 2021].

UK Government (Last updated 3 April 2018) *Groundwater risk assessment for your environmental permit*. [online] Available at: https://www.gov.uk/guidance/groundwater-risk-assessment-for-your-environmental-permit [Accessed 23 Nov. 2021].

UK Government National Archives (n.d.) *Pollution prevention advice and guidance (PPG)* [online] Available at: https://webarchive.nationalarchives.gov.uk/ukgwa/20140328090931/http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx [Accessed 23 Nov. 2021].

APPENDIX 1 SITE LAYOUT



EA THREE DCO Corridor

EA THREE Onshore Converter Station Layout Detail

EA THREE Onshore Converter Station Temporary Site Facilities Detail

EA THREE Converter Substation to National Grid Substation Cable Route

400kV AC Cable - Open Cut Section

400kV AC Cable - Ducted Section

EA THREE Onshore Converter Station Access Roads

Permanent

Temporary

EA THREE Cable Access Road

Haul Road

EA THREE Onshore Converter Station SUDs Pond

EA THREE Area to be Reprofiled

EA ONE Onshore Converter Station Access Road

Works No.s

62, 63, 64, 65, 66, 67, 68, 69

GoBe consultants

Rev	Date	By	Comment
B	04/04/2022	PW	Second Issue
A	31/03/2022	JRS	First Issue

Original A3 Plot Scale 1:5,000

0 100 200 Metres

Onshore Converter Station Stage

Figure 1: Site Context Plan

Drg No	05356.00006.12.0001.1 ONCS Site Context Plan
Rev	2
Date	04/04/2022
Layout	N/A

Document Path: P:\05356 - GoBe Consultants Ltd\00006 East Anglia Three\Tech\GIS\Dwgs\Wking\EA3\Onshore Substation\ONCS and Commencement Master\5356.00006.12.0020.1 ONCS Site Context.mxd

APPENDIX 2 HISTORIC BGS BOREHOLE LOGS

BGS BOREHOLE REFERENCE: TM04NE29

Easting: 609780
Northing: 247080
Date: 1941
Length: 32.15m

TM 04 NE/29
0978.4708

207/466 Tye House, Bramford

Surface +175. Shaft 105½; rest bore. Depth unknown. Shaft dry. Ferruginous. *Before 1941.*

Shaft dry. Yield c. 800 g.p.d. Electric pump. *June 1960.*

Pleist. Drift) UCk)	...	...	105¼+	105¼+

207/466 Tye House, Bramford TM04/77
TM 0967 4707
Surface +175. Shaft 105½; rest bore. Depth unknown. Shaft dry. Ferruginous.
Before 1941.
Shaft dry. Yield c. 800 g.p.d. Electric pump. *June 1960.*

Pleist. Drift) UCk)	...	...	105½+	105½+

BGS BOREHOLE REFERENCE: TM04NE48

Easting: 609160

Northing: 245340

Date: 1952

Length: 62.17m

TM 04 NE/48
0916.4534

207/721 Canes Farm, Burstall

Surface +169. Lining tubes: 130 x 4 in from surface. Ck +58. R.W.L. +67. P.W.L. +65. Yield 540 g.p.h. (test). *Brown, Aug. 1952.* Yield 500 g.p.d. I/c engine. *June 1960.*

Boulder Clay	...	...	60	60
Sand and Gravel	...	...	6	66
WRB	...	...	45	111
UCk	...	...	93	204

Boulder clay	Soil	2	2
	Yellow clay	20	22
	Blue "	33	55
	Brown "	5	60
	Sand & gravel	6	66
WRB	Blue clay	5	71
	Grey hard silt	15	86
	Black " "	10	96
	Green — "	15	111
	Chalk	93	204

RA/1964

N.4767

STRATA RECORD

Phone: IPSWICH 2073.

J. R. BROWN & Co., Ltd.,

ARTESIAN WELL ENGINEERS,

28-32, BURRELL ROAD,

IPSWICH.

LOCATION.
TM 04/73
BURSTALL.

CANES FARM.

Name J.F.King,Esq., Building Contractor. Address New Works,Dales Road,IPSWICH,Suffolk.

Bore Dia. 4" Total Depth 204 Feet. Water Level 102 Feet.

Lining Dia. 4" Lining Depth 130 Feet. Date 21st.August,1952.

	STRATA.	THICKNESS. Ft.	THICKNESS. In.	DEPTH. Ft.	DEPTH. In.
Boulder Clay 60	Soil.	2	-	2	-
	Yellow Clay.	20	-	22	-
	Blue Clay.	33	-	55	-
	Brown Clay.	5	-	60	-
Sand and Gravel 6	Sand & Gravel.	6	-	66	-
WRB 45	Blue Clay.	5	-	71	-
	Grey Hard Silt.	15	-	86	-
	Black Hard Silt.	10	-	96	-
	Green Silt.	15	-	111	-
UCk 93	CHALK.	93	-	204	-

RD/1964.

Yield. 540 G.P.H.
Pumping Level 104 feet.
Fig. 24 H. Power Head & 1½ H.P.Lister Engine.

107 Feet. 1½" Rising Main.
10½ Feet. 1½" Suction.
108 Feet. ⅜" Tubular Rods.
1½" Footvalve.
3" Non-Extractable Cylinder.

Fruse. c/c engine.
Use 500 gpd average, sometimes more.
OD + 169.
Unsited RCD 16.6.60.

Sited by J.C. Brown on Suffolk
74 NE/E.

P.M.C 19.11.52.

C + 155 from 1:25000

DATA Bank

Rec. 1.9.52.

BGS BOREHOLE REFERENCE: TM04NE49

Easting: 609610

Northing: 246860

Date: 1948

Length: 82.90m

TM 04 NE/49
0961 · 4686

207/601 Woodlands Farm, Bramford Tye, Bramford

Surface +170. Lining tubes: 197 × 4 in from surface. Water struck at +38 and -90. R.W.L. +38. Suction +16. Yield 500 g.p.h. (8 h. test). *Thurston, May 1948.* Yield c. 1,500 g.p.d. Electric pump. *June 1960.*

Boulder Clay	35	35
Sand and Gravel	42	77
UCk	195	272

Boulder Clay 35	Topsoil	1. 6.	1. 6.
	Yellow Clay & chalk stones	11 · 6	13. 0
	Blue clay & chalk stones	22 · 0	35 · 0
S&G. 42.	Red Sand	10 · 0	45 · 0
	Brown Sand	9 · 0	54 · 0
	Light Brown Sand & Bands of Silt	23 · 0	77 · 0
UCk. 195.	Chalk (Poor & Dry)	55 · 0	132 · 0
	Chalk (Bearing water)	140 · 0	272 · 0

RA.

These beds might be Tertiary (LLT) in part.
[initials] 8.5.90

TM 0959 4686 TM04/74

207/601 Woodlands Farm, Bramford Tye, Bramford

Surface +170. Lining tubes: 197 × 4 in from surface. Water struck at +38 and -90. R.W.L. +38. Suction +16. Yield 500 g.p.h. (8 h. test). *Thurston, May 1948.* Yield c. 1,500 g.p.d. Electric pump. *June 1960.*

Boulder Clay	...	...	35	35
Sand and Gravel	...	...	42	77
UCk	...	...	195	272

Boulder Clay 35	Topsoil	1. 6.	1. 6
	Yellow Clay & chalk stones	11. 6	13. 0
	Blue clay & Chalk stones	22. 0	35. 0
S&G 42.	Red Sand	10. 0	45. 0
	Brown Sand	9. 0	54. 0
	Light Brown sand & Bands of Silt	28. 0	77. 0
UCk 195.	Chalk (Poor & Dry)	55. 0	132. 0
	Chalk (Bearing water)	140. 0	272. 0

RA.

1063 Wt. 22438/0384 10M 7/45 (51) F.&S.

RECORD OF WELL (SHAFT OR BORE)

(For Survey use only)
1-inch Map Registered No. N.1924
207/601 TM04/74

At Woodlands Farm,
Town or Village Bramford Tye, Nr. Ipswich. (Bramford,)
County Suffolk. Six-inch quarter sheet 74 NE E
For East Suffolk Agricultural Committee.

Exact site of well .... (Attach a tracing from a map, or a sketch-map, if possible.)

Level of ground surface above sea level (O.D.) + c. 170 ft. If well-top is not at ground level, state how far ... above; below; ......ft.

SHAFT ......ft.; diameter ......ft. Details of headings ......

BORE 272 ft.; diameter of bore: at top 4 ins.; at bottom 4 ins. Lengths, diameters, perforations, etc., of lining tubes 197 ft - 1 ins of 4" Tube.

Water struck at depths, below well top, of (feet) 132 ft. 260 ft.

Rest-level of water 132 ft. below well-top. Suction at 154 ft. Yield on 8 hours' pumping, 500 gal. per Hour with depression to - ft. below well-top, Capacity of pump 700 g.p.h. Recovery to rest level in - mins. hours Date of measurements May. 1948. Date of well May. 1948.

Quality of water (*attach copy of analysis if available*) ......

Well made by H.G. Thurston & Co. Lodge Works, Old Newton, Stowmarket.
Information from H.G. Thurston & Co. Old Newton Stowmarket, Suffolk.

Additional notes in space overleaf.

(For Survey use only) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS Feet	THICKNESS Ins.	DEPTH Feet	DEPTH Ins.
	If measurements start below ground surface, e.g., from bottom of an existing shaft, state how far				
Boulder clay 35	Topsoil.	1	6	1	6
	Yellow Clay and Chalk Stomes.	11	6	13	0
	Blue Clay and Chaak Stones.	22	0	35	0
S & G. 42	Red Sand.	10	0	45	0
	Browne Sand.	9	0	54	0
	Light Brown Sand and Bands of Silt.	23	0	77	0
UCk 195	Chalk. (Poor and Dry)	55	0	132	0
	Chalk. (Bearing Water)	140	0	272	0
RA					

(Marked absence of Flints in Chalk)
Electric pump in use. Shortly to be disused when farm goes on to mains supply.
OD + c. 170. Inaccessible.
Use c. 1,500 g.p.d.
RCB. 16.6.60

DATA Bank *Continued overleaf*

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.	Date received	Correspondence File No.	1" N.S. Map No.	1" O.S. Map No.	Site marked (use symbol) on 1" Map	on 6" Map
	21.6.48		207		O	O

BGS BOREHOLE REFERENCE: TM14NW31

Easting: 610290

Northing: 246440

Date: -

Length: 19.80m

TM 14 NW/31

TM 14 NW 31 **1029 4644** **near Bullenhall Farm, Bramford** **Block B**

Surface level (+50.0 m) +164 ft
Water not struck
Wirth B1, 8 in diameter
March 1970

Waste 19.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown or grey, chalky, with occasional sand lenses	19.5+	19.8

Institute of Geological Sciences

Mineral Assessment Unit

Sand and Gravel Survey

BOREHOLE RECORD SHEET

Borehole Reg. No.: TM 14 NW - 31.

Nat. Grid Ref.: 1029 4644

Locality:

Date: 17-13-70

Recorded by: A.R. Clayton

Drilled by: Fitzpatrick

Drill Type: Wilt B1.

Hole diameter:

Ground level (O.D.):

Water struck at (O.D.):

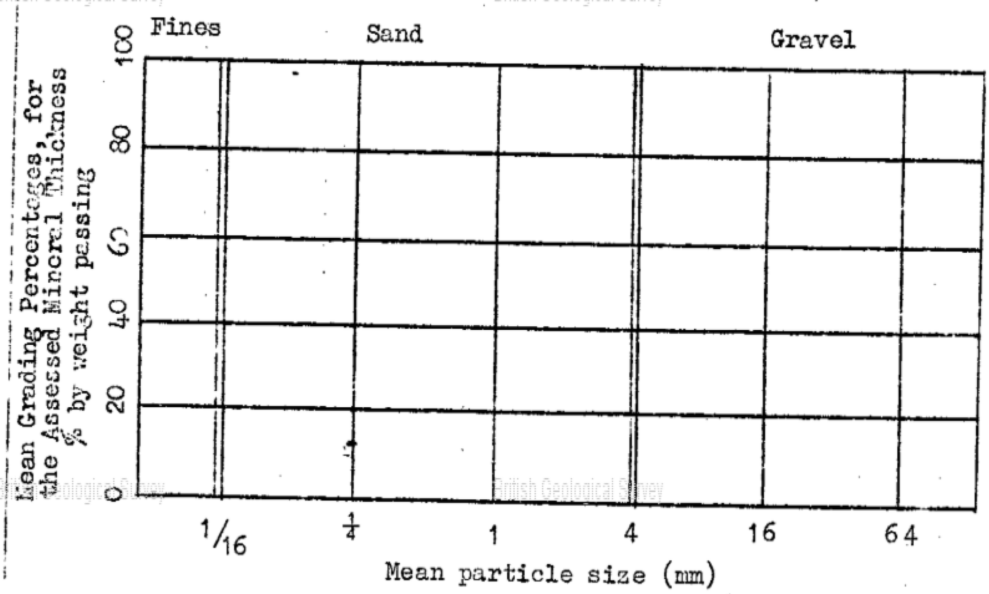
Summary of ground penetrated	Thickn. m	Thickn. ft	Nature
		~~65~~ 64	Boulder Clays.

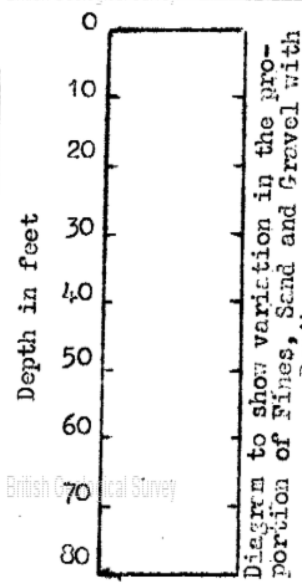
Remarks

Depth bailed:

Grading Record

Mean Grading percentages:	Fines	Sand	Gravel





Description of Strata	Depth to base ft.	Thickn. ft.	Sample Nos.
Topsoil	1.0	1.0	
Light brown boulder clay with chalk and tr. sand. Chalk from 2-15 mm. with tr med chalk sand.	13.0	12.0	
Med. chalky sand with fine chalk gravel.	16.0	3.0	
V. Chalky med sand with fine and med chalk gravel.	19.0	3.0	
Light brown-grey clay with chalk gravel upto 30 mm, rare chalky sand band.	22.0	3.0	

[50]

Description of Strata (continued)	Depth to base ft	Thickn. ft	Sample Nos.
Light brown chalky clay with tr. med-co chalk sand and with chalk gravel upto 30 mm. and flint gravel upto 20 mm.	30.0	8.0	
Dark grey boulder clay with chalk fragments upto 20 mm. with weathered surface 2 feet deep.	61.0	31.0	
Light brown/grey boulder clay with included chalk gravel and traces of sandy layers.	65.0	4.0	

Sample Depths

Sample No.	Depth	Remarks

BGS BOREHOLE REFERENCE: TM14NW157

Easting: 610280

Northing: 246450

Date: 1946

Length: 70.10m

TM 14 NW/187
1028·4645

207/808 Bullen Hall Farm, Bramford

Surface +162. (49·39) Lining tubes: 145 × 4 in from surface. Ck +80. R.W.L. +23½

Yield 500 g.p.h. *Brown, May 1946.*

Electric pump. *1960.*

Pleist. Drift	... ...	61	61	18·59 m
WRB	... ...	21	82	25
UCk	... ...	148	230	70·1

~~127~~

(~~26140~~)

Pleist Drift	Surface soil	2	2	0·61
	Yellow clay	5	7	2·1
	Blue " & stones	13	20	6·1
	Gravel	10	30	9·1
	Boulder clay	27	57	17·4
	Gravel	4	61	18·6
WRB	L.C.	4	65	19·82
	Mottled clay	16	81	24·7
	Flints	1	82	25
	Chalk	148	230	70·1

7.1

207/808 **Bullen Hall Farm, Bramford** TM14/163

TM1027 4645

Surface +162. Lining tubes: 145 × 4 in from surface. Ck +80. R.W.L. +23½

Yield 500 g.p.h. *Brown, May 1946.*

Electric pump. *1960.*

Pleist. Drift	... ...	61	61
WRB	... ...	21	82
UCk	... ...	148	230

~~(36149)~~ ~~127~~

Pleist Drift	Surface soil	2	2
	Yellow clay	5	7
	Blue " + stones	13	20
	Gravel	10	30
	Boulder clay	27	57
	Gravel	4	61
WRB	L.C.	4	65
	Mottled clay	16	81
	Flints	1	82
	Chalk	148	230

RA

9, (1)

TM14/1163

Phone: IPSWICH 2073.

J. R. BROWN & Co., Ltd.,

ARTESIAN WELL ENGINEERS,

28-32, BURRELL ROAD,

IPSWICH.

207 LOCATION.

~~BRAMFORD~~

808 L

Site: Bullen Hall Farm, Bramford.

Name H.Fiske Esqr. Address Thornbush,Bramford., IPSWICH.

Bore Dia. 4" Total Depth 230 feet Water Level 138½ ft.

Lining Dia. 4"i.d. Lining Depth 145 ft. Date 4th May,1946.

	STRATA.	THICKNESS. Ft.	THICKNESS. In.	DEPTH. Ft.	DEPTH. In.
Pleist Drift 61	Surface Soil.	2	-	2	-
	Yellow Clay.	5	-	7	-
	Blue Clay & Stones.	13	-	20	-
	Gravel.	10	-	30	-
	Boulder Clay.	27	-	57	-
	Gravel.	4	-	61	-
WRB 21	London Clay.	4	-	65	-
	Mottled Clay.	16	-	81	-
	Flints .	1	-	82	-
U Ck 148	CHALK.	148	-	230	-

RB/.

Yield- 500 G.P.H.

PUMP 19½ ft. 1¼"Suction.
1. 3" Pump Cylinder.
137½ ft. 1½"dia Galv Rising Main.
and ⅜" Galv Pump Rods.
1. Fig 24A No.0 "Climax" O.B.Power Head.

20/6/46
Sited on Suffolk 75 NW/W by
J. R. Brown.

According to Mrs. Mayhew, this is at Bullen Hall Farm
Site corrected. Inaccessible electric automatic pump. Yield unknown.

Rec'd 4.6.46

OD + 162.

Visited. RAD. 17.6.60.

BGS BOREHOLE REFERENCE: TM14NW158

Easting: 610360
Northing: 246140
Date: 1935
Length: 76.20m

TM 14 NW / [illegible] 158

1036.4614

207/385 **Bullen Farm, Bramford.** (Disused)

53.35

Surface +175. Lining tubes: 167 × 4½ in from surface. Ck +65. R.W.L. +22.

Gosling, Oct. 1935.

I/c engine. *1941.*

Pleist. Drift)	...	...	70	70
LC)			40	110
WRB	...	...	140	250
UCk	...	...		

	Yellow clay	} ? Bo clay & L.C	16.	16	4.88
	Blue "		54	70	21.34
	Green loam	} W.R.B.	8	78	23.78
	Blue clay		22	100	30.49
	Green sand		10	110	33.54
Chalk.	Chalk		140	250.	76.22

AWW / 4.9.44 ✓RA.

AWW / XII.41

TM14/97

207/385A

RECORD OF WELL (SHAFT OR BORE)

At Bullen Farm

Town or Village Bramford

County Suffolk Six-inch quarter sheet 75 NW/S

For Mr. Southgate

Exact site of well ______ (Attach a tracing from a map, or a sketch-map, if possible.)

Level of ground surface above sea-level (O.D.) ~~140~~ 175 feet.

Is well-top at ground level? ______ If not, state how far above/below; ______ feet.

Shaft ______ ft., diameter ______ ft. Details of headings ______

Bore 250 ft.; diameter of bore: at top $4\frac{1}{2}$ ins.; at bottom ______ ins.

Lengths, diameters, perforations, etc., of lining tubes 167' × $4\frac{1}{2}$"

Water struck at depths, below well-top, of (feet) ______

TEST DETAILS Rest-level of water 153 ft. ~~above~~ below well-top. Suction at ______ ft. Yield on ______ hours'/days'

Month ______ pumping ______ gallons per ______ (max. capacity of pump ______ g.p.h.),

Year ______ with depression of ______ feet. Recovery to ______ in ______ mins./hours.

WORKING CONDITIONS

Rest-level of water in ______ (month), ______ (year), ______ ft. above/below well-top.

Highest ,, in ______ (month), ______ (year), ______ ft. above/below ,,

Lowest ,, in ______ (month), ______ (year), ______ ft. above/below ,,

Suction at ______ ft. Rate of pumping ______ galls. per ______ for ______ hours per day.

with average depression of ______ ft. Recovery to ______ in ______ mins./hours

Quality of water (*attach copy of analysis if available*) ______

Well made by J. J. Gosling, Ipswich Date of well Oct 1935

Information from Do per AWW

ADDITIONAL NOTES.

Petrol-paraffin Engine. Yield unknown, as present occupier has only just moved in.

Visited and sited on 6in. map

AWW 24. X. 41

Farm unoccupied.

Belongs to A. Mayhew, Bullen Hall Farm.

(For Survey use only) Geological Classification	Nature of Strata. If measurements start below ground surface, state how far...		Thickness Feet ...	Thickness Inches ...	Depth Feet	Depth Inches
Boulder Clay	Yellow clay	? Bo. Clay & L.C	16		16	
	Blue "		54		70	
Glacial Sand &c	Green loam	WRB	8		78	
~~London Clay~~	Blue clay		22		100	
Woolwich R. Beds	Green sand		10		110	
Chalk	Chalk		140		250	

AWW 9.9.44 ✓RA.

AWW XI-41

DATA Bank

APPENDIX 3 WAVENEY AND EAST SUFFOLK CHALK & CRAG WATER BODY CLASSIFICATION CRITERIA

Waveney and East Suffolk Chalk & Crag Water Body: Poor overall status
Water Body ID GB40501G400600
Classifications

Classification Item	2013	2014	2015	2016	2019
Overall Water Body	Poor	Poor	Poor	Poor	Poor
Quantitative	Poor	Poor	Poor	Poor	Poor
Quantitative Status element	Poor	Poor	Poor	Poor	Poor
Quantitative Dependent Surface Water Body Status	Good	Good	Good	Good	Poor
Quantitative GWDTEs test	Good	Good	Good	Good	Good
Quantitative Saline Intrusion	Good	Good	Good	Good	Good
Quantitative Water Balance	Poor	Poor	Poor	Poor	Good
Chemical (GW)	Poor	Poor	Poor	Poor	Poor
Chemical Status element	Poor	Poor	Poor	Poor	Poor
Chemical Dependent Surface Water Body Status	Good	Good	Good	Good	Good
Chemical Drinking Water Protected Area	Poor	Poor	Poor	Poor	Poor
Chemical GWDTEs test	Good	Good	Good	Good	Good
Chemical Saline Intrusion	Good	Good	Good	Good	Good
General Chemical Test	Poor	Poor	Poor	Poor	Poor
Supporting elements (Groundwater)					
Prevent and Limit Objective	Active				Active
Trend Assessment	Upward trend	Upward trend	Upward trend	Upward trend	Upward trend

APPENDIX 4 GIPPING (D-S STOWMARKET) WATER BODY & BELSTEAD BROOK WATER BODY CLASSIFICATION CRITERIA

Gipping (d/s Stowmarket) Water Body: Poor ecological status
Water Body ID GB105035046280
Classifications

Classification Item	2013	2014	2015	2016	2019
Ecological	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Poor**
Biological quality elements	**Good**	**Good**	**Moderate**	**Moderate**	**Poor**
Fish	**Good**	**High**	**High**	**High**	**High**
Invertebrates	**Good**	**Good**	**High**	**High**	**Good**
Macrophytes and Phytobenthos Combined		**High**	**Moderate**	**Moderate**	**Poor**
Physico-chemical quality elements	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**
Acid Neutralising Capacity		**High**	**High**	**High**	**High**
Ammonia (Phys-Chem)	**High**	**High**	**High**	**High**	**High**
Biochemical Oxygen Demand (BOD)	**High**	**High**	**High**	**High**	
Dissolved oxygen	**Moderate**	**Good**	**Good**	**Good**	**Poor**
Phosphate	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Poor**
Temperature	**High**	**High**	**High**	**High**	**Good**
pH	**High**	**High**	**High**	**High**	**High**
Hydromorphological Supporting Elements	**Supports good**	**Supports good**	**Supports good**	**Supports good**	**Supports good**
Hydrological Regime	**Does not support good**	**Does not support good**	**Does not support good**	**Does not support good**	**Does not support good**
Supporting elements (Surface Water)	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**
Mitigation Measures Assessment	**Moderate or less**	**Moderate or less**	**Moderate or less**	**Moderate or less**	**Moderate or less**
Specific pollutants	**High**	**High**	**High**	**High**	**High**
Chlorothalonil					**High**
Chromium (VI)					**High**
Copper	**High**	**High**	**High**	**High**	**High**
Iron					**High**
Pendimethalin					**High**
Triclosan	**High**	**High**			
Zinc	**High**	**High**	**High**	**High**	**High**
Other Substances					
1-1-1-trichloroethane	**High**				
Chemical	**Good**	**Good**	**Good**	**Good**	**Fail**
Priority hazardous substances	**Good**	**Good**	**Good**	**Good**	**Fail**
Benzo(a)pyrene					**Good**
Cadmium and Its Compounds	**Good**	**Good**	**Good**	**Good**	**Good**
Di(2-ethylhexyl)phthalate (Priority hazardous)	**Good**	**Good**	**Good**	**Good**	**Good**
Dioxins and dioxin-like compounds					**Good**
Endosulfan	**Good**	**Good**	**Good**		
Heptachlor and cis-Heptachlor epoxide					**Good**

Gipping (d/s Stowmarket) Water Body: Poor ecological status
Water Body ID GB105035046280
Classifications

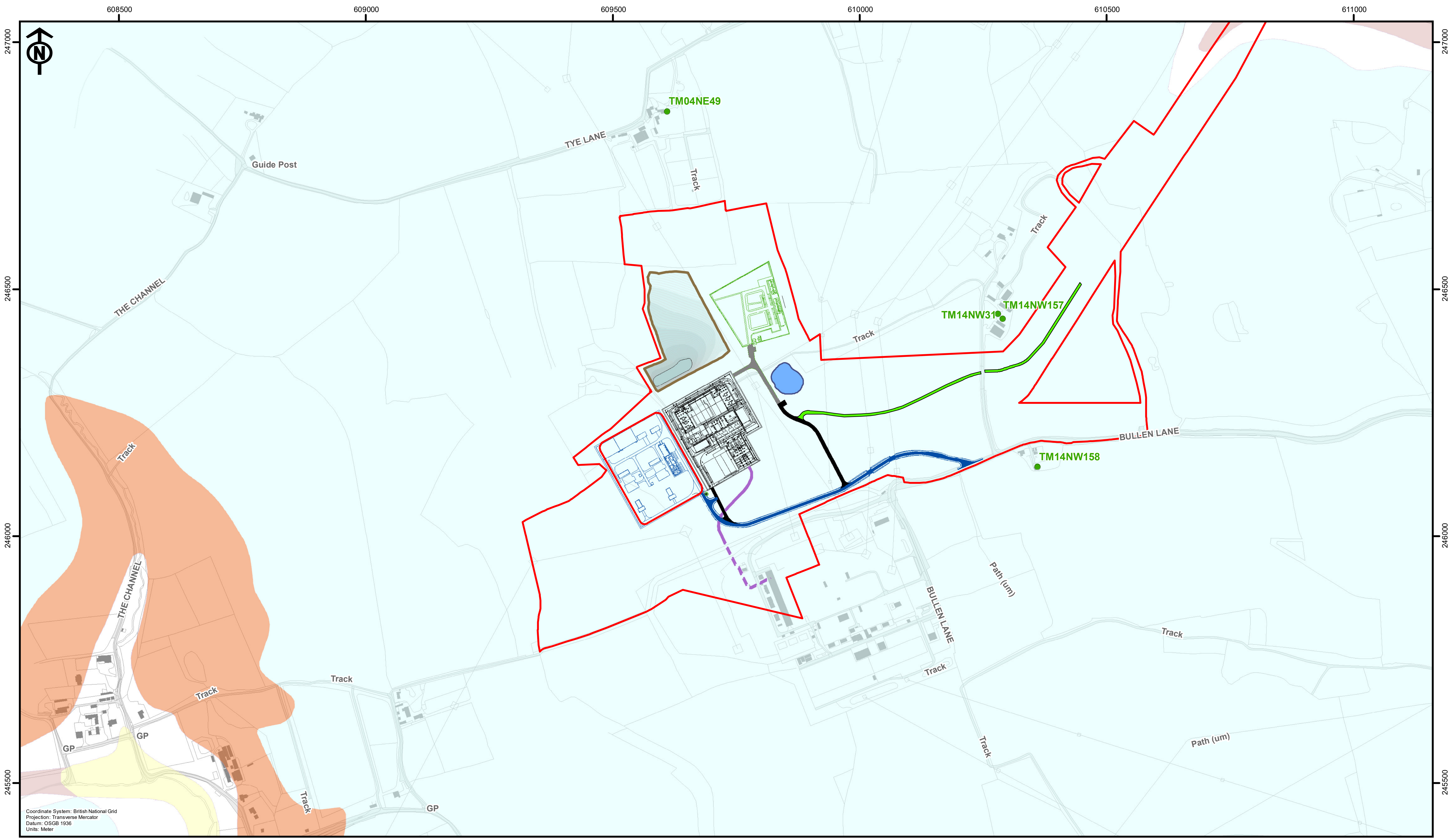
Classification Item	2013	2014	2015	2016	2019
Hexabromocyclododecane (HBCDD)					**Good**
Hexachlorobenzene					**Good**
Hexachlorobutadiene					**Good**
Hexachlorocyclohexane	**Good**	**Good**	**Good**	**Good**	**Good**
Mercury and Its Compounds			**Good**	**Good**	**Fail**
Nonylphenol	**Good**	**Good**	**Good**	**Good**	**Good**
Perfluorooctane sulphonate (PFOS)					**Fail**
Polybrominated diphenyl ethers (PBDE)					**Fail**
Quinoxyfen					**Good**
Tributyltin Compounds	**Good**	**Good**			
Trifluralin (Priority hazardous)	**Good**	**Good**	**Good**	**Good**	**Good**
Priority substances	**Good**	**Good**	**Good**	**Good**	**Good**
1,2-dichloroethane	**Good**	**Good**	**Good**	**Good**	**Good**
Aclonifen					**Good**
Alachlor					**Good**
Bifenox					**Good**
Cybutryne (Irgarol®)					**Good**
Cypermethrin (Priority hazardous)					**Good**
Dichlorvos (Priority)					**Good**
Fluoranthene					**Good**
Lead and Its Compounds	**Good**	**Good**	**Good**	**Good**	**Good**
Nickel and Its Compounds	**Good**	**Good**	**Good**	**Good**	**Good**
Trichloromethane	**Good**	**Good**	**Good**	**Good**	**Good**
Other Pollutants	**Good**	**Good**	**Good**	**Good**	**Good**
Aldrin, Dieldrin, Endrin & Isodrin	**Good**	**Good**	**Good**	**Good**	**Good**
Carbon Tetrachloride	**Good**	**Good**	**Good**	**Good**	**Good**
Trichloroethylene	**Good**	**Good**	**Good**	**Good**	**Good**
para - para DDT	**Good**	**Good**	**Good**	**Good**	**Good**

Belstead Brook Water Body: Poor ecological status
Water Body ID GB105035040440
Classifications

Classification Item	2013	2014	2015	2016	2019
Ecological	Poor	Poor	Poor	Poor	Poor
Biological quality elements	Poor	Poor	Poor	Poor	Poor
Fish	Poor	Poor	Poor	Poor	Poor
Invertebrates	Good	Good	High	High	High
Macrophytes and Phytobenthos Combined		Moderate	Moderate	Moderate	Moderate
Physico-chemical quality elements		Moderate	Moderate	Moderate	Moderate
Ammonia (Phys-Chem)		Good	High	High	Good
Dissolved oxygen		High	High	High	High
Phosphate		Poor	Moderate	Moderate	Moderate
Temperature		High	High	High	Good
pH		High	High	High	High
Hydromorphological Supporting Elements	Supports good	Supports good	Supports good	Supports good	Supports good
Hydrological Regime	Supports good	Supports good	Supports good	Supports good	Supports good
Morphology	Supports good	Supports good	Supports good	Supports good	Supports good
Specific pollutants	High	High			
Copper	High	High			
Triclosan	High	High			
Zinc	High	High			
Chemical	Good	Good	Good	Good	Fail
Priority hazardous substances	Good	Good	Does not require assessment	Good	Fail
Benzo(a)pyrene					Good
Benzo(b)fluoranthene					Good
Benzo(g-h-i)perylene					Good
Benzo(k)fluoranthene					Good
Cadmium and Its Compounds	Good	Good			
Di(2-ethylhexyl)phthalate (Priority hazardous)	Good	Good			
Dioxins and dioxin-like compounds					Good
Heptachlor and cis-Heptachlor epoxide					Good
Hexabromocyclododecane (HBCDD)					Good
Hexachlorobenzene					Good
Hexachlorobutadiene					Good
Mercury and Its Compounds					Fail
Nonylphenol	Good	Good			
Perfluorooctane sulphonate (PFOS)					Good
Polybrominated diphenyl ethers (PBDE)				Good	Fail
Tributyltin Compounds	Good	Good			

Belstead Brook Water Body: Poor ecological status
Water Body ID GB105035040440
Classifications

Classification Item	2013	2014	2015	2016	2019
Priority substances	Good	Good	Does not require assessment	Does not require assessment	Good
Cypermethrin (Priority hazardous)					Good
Fluoranthene					Good
Lead and Its Compounds	Good	Good			
Nickel and Its Compounds	Good	Good			
Other Pollutants	Does not require assessment	Does not require assessment	Does not require assessment	Does not require assessment	Does not require assessment



EA THREE DCO Corridor	**EA THREE Converter Substation to National Grid Substation Cable Route**	**EA THREE Onshore Converter Station Access Roads**	**EA THREE Cable Access Road**	EA ONE Onshore Converter Station Access Road	Head - Diamicton
EA THREE Onshore Converter Station Layout Detail	400kV AC Cable - Open Cut Section	Permanent	Haul Road	Historic BGS Geological Log	Lowestoft Formation - Diamiction
EA THREE Onshore Converter Station Temporary Site Facilities Detail	400kV AC Cable - Ducted Section	Temporary	EA THREE Onshore Converter Station SUDs Pond	**Superficial Geology**	Lowestoft Formation - Sand and Gravel
			EA THREE Area to be Reprofiled	Alluvium - Clay and Silt	

GoBe consultants

Rev	Date	By	Comment
B	14/04/2022	PW	Second Issue
A	24/01/2022	PW	First Issue

Original A3 Plot Scale 1:7,500

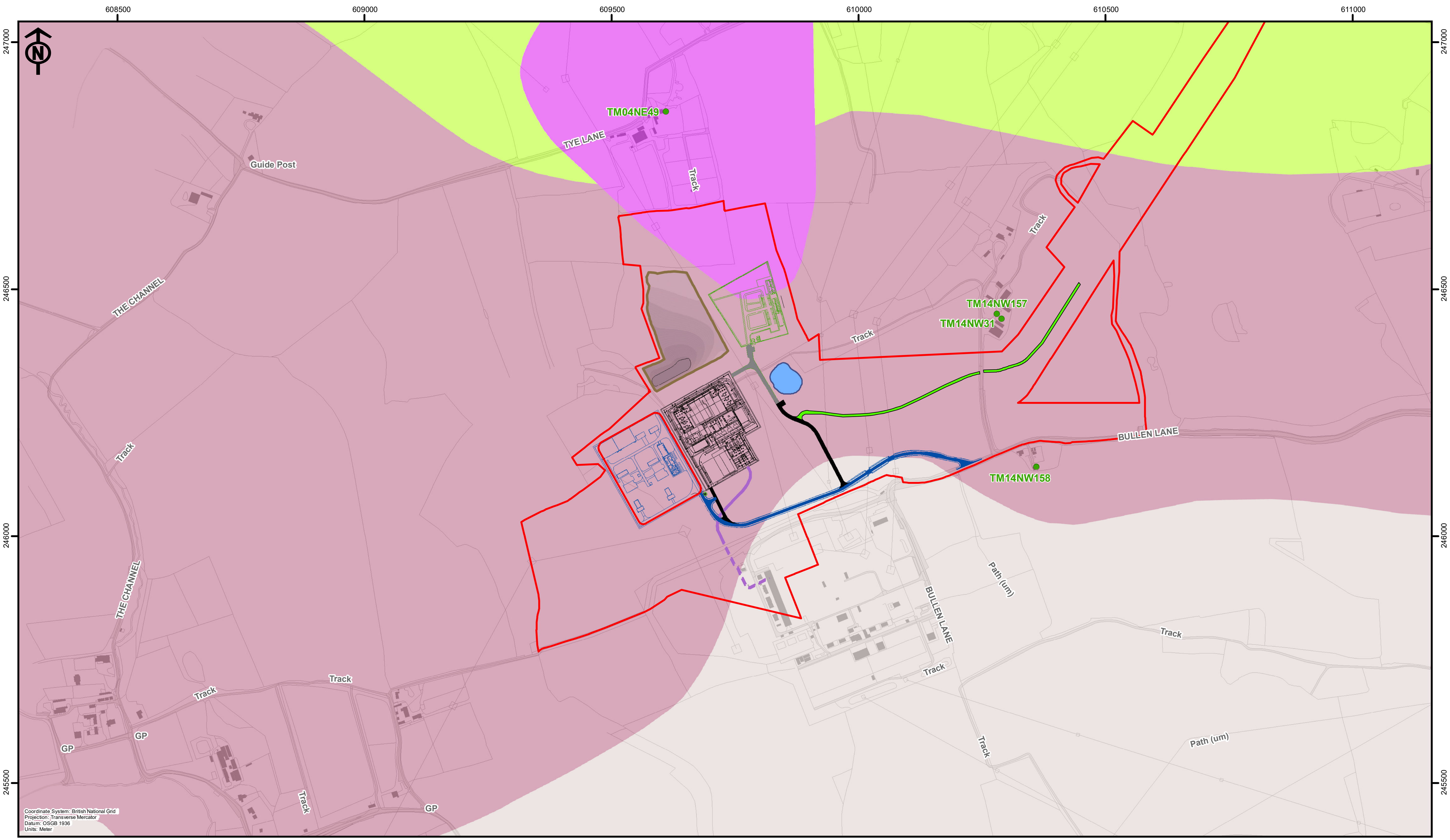
0 150 300 Metres

Onshore Converter Station Stage

Figure 1: Superficial Deposits

Drg No	05356.00006.12.00027.1 ONCS Superficial Deposits
Rev	2
Date	14/04/2022
Layout	N/A

Document Path: P:\05356 - GoBe Consultants Ltd\00006 East Anglia Three\Tech\GIS\Dwgs\Wking\EA3\Onshore Substation\Doc Ref EA3-GRD-CON-PLN-IBR-000107\ONCS\5356.00006.0027.10.1 Converter Station EA3 Superficial Bepostits.mxd



EA THREE DCO Corridor

EA THREE Onshore Converter Station Layout Detail

EA THREE Onshore Converter Station Temporary Site Facilities Detail

EA THREE Converter Substation to National Grid Substation Cable Route

400kV AC Cable - Open Cut Section

400kV AC Cable - Ducted Section

EA THREE Onshore Converter Station Access Roads

Permanent

Temporary

EA THREE Cable Access Road

Haul Road

EA THREE Onshore Converter Station SUDs Pond

EA THREE Area to be Reprofiled

EA ONE Onshore Converter Station Access Road

Historic BGS Geological Log

Bedrock Geology

Red Crag Formation - Sand (Quaternary)

Thames Group - Clay, Silt And Sand (Paleogene)

Thanet Formation And Lambeth Group (Undifferentiated) - Clay And Sand (Paleogene)

Newhaven Chalk Formation - Chalk (Cretaceous)

GoBe consultants

Rev	Date	By	Comment
B	14/04/2022	PW	Second Issue
A	24/01/2022	PW	First Issue

Original A3 Plot Scale 1:7,500

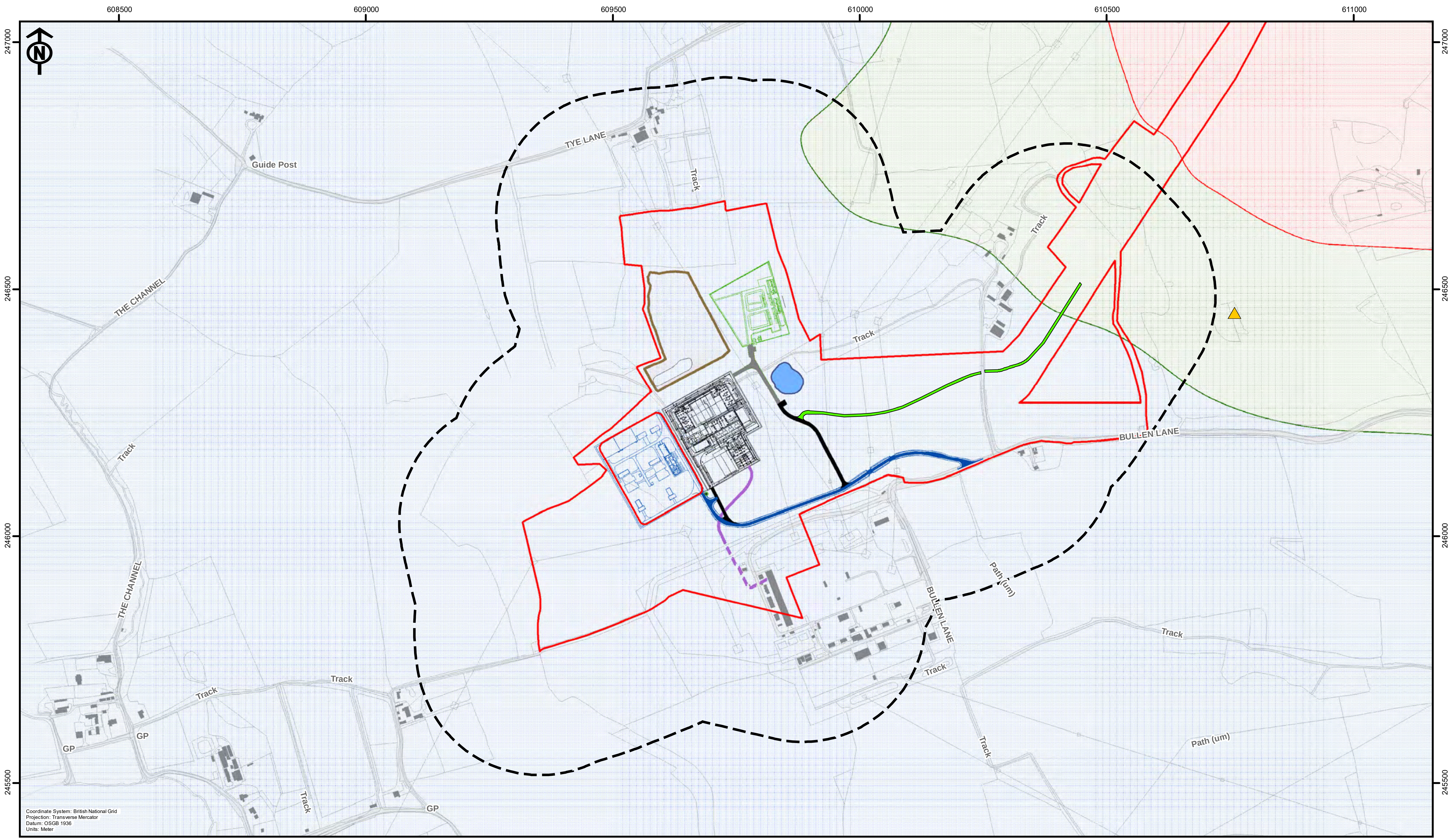
0 150 300 Metres

Onshore Converter Station Stage

Figure 2: Bedrock Geology

Drg No	05356.00006.12.0028.1 ONCS Bedrock Geology
Rev	2
Date	14/04/2022
Layout	N/A

Document Path: P:\05356 - GoBe Consultants Ltd\00006 East Anglia Three\Tech\GIS\Dwgs\Wking\EA3\Onshore Substation\Doc Ref EA3-GRD-CON-PLN-IBR-000107\ONCS\5356.00006.0028.10.1 Converter Station EA3 Bedrock Geology.mxd



Legend

- EA THREE DCO Corridor
- EA THREE Onshore Converter Station Layout Detail
- EA THREE Onshore Converter Station Temporary Site Facilities Detail
- Converter Station Wokrs Area 250 m Buffer

EA THREE Converter Substation to National Grid Substation Cable Route

- 400kV AC Cable - Open Cut Section
- 400kV AC Cable - Ducted Section

EA THREE Onshore Converter Station Access Roads

- Permanent
- Temporary

EA THREE Cable Access Road

- Haul Road
- EA THREE Onshore Converter Station SUDs Pond
- EA THREE Area to be Reprofiled
- EA ONE Onshore Converter Station Access Road

Springs

- Depression subject to groundwater inflow

Source Protection Zones

- Zone I - Inner Protection Zone
- Zone II - Outer Protection Zone
- Zone II - Total Catchment

GoBe consultants

Rev	Date	By	Comment
B	14/04/2022	PW	Second Issue
A	24/01/2022	PW	First Issue

Original A3 Plot Scale 1:7,500

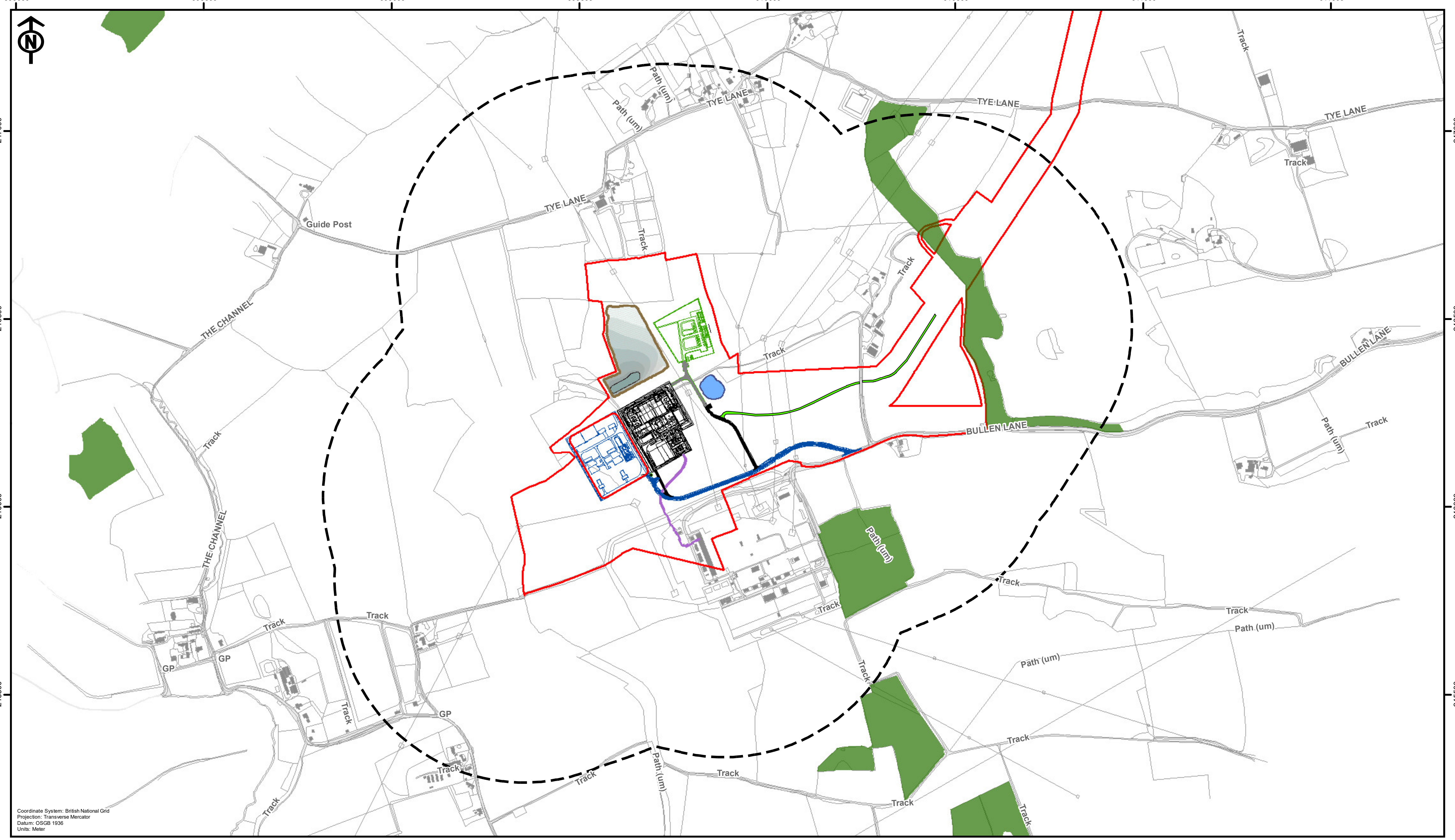
0 150 300 Metres

Onshore Converter Station Stage

Figure 4: Location of all Current Abstraction Licences, Private Abstractions and Source Protection Zones

Drg No	05356.00006.12.0001.1 ONCS SPZ and Abstractions
Rev	2
Date	14/04/2022
Layout	N/A

Document Path: P:\05356 - GoBe Consultants Ltd\00006 East Anglia Three\Tech\GIS\Dwgs\Wking\EA3\Onshore Substation\Doc Ref EA3-GRD-CON-PLN-IBR-000107\ONCS\5356.00006.12.10.1 Converter Station EA3 SPZ and Abstractions.mxd



EA THREE DCO Corridor	Converter Station Works Area 500 m Buffer
EA THREE Onshore Converter Station Layout Detail	400kV AC Cable - Ducted Section
EA THREE Onshore Converter Station Temporary Site Facilities Detail	

EA THREE Converter Substation to National Grid Substation Cable Route

- 400kV AC Cable - Open Cut Section

EA THREE Onshore Converter Station Access Roads

- Permanent
- Temporary

EA THREE Cable Access Road

- Haul Road
- EA THREE Onshore Converter Station SUDs Pond
- EA THREE Area to be Reprofiled

EA ONE Onshore Converter Station Access Road

Ecology Designations

- Ancient Woodland

GoBe consultants

Rev	Date	By	Comment
B	14/04/2022	PW	Second Issue
A	24/01/2022	PW	First Issue

Original A3 Plot Scale 1:10,000

0 200 400 Metres

Onshore Converter Station Stage

Figure 5: Ecological Sites

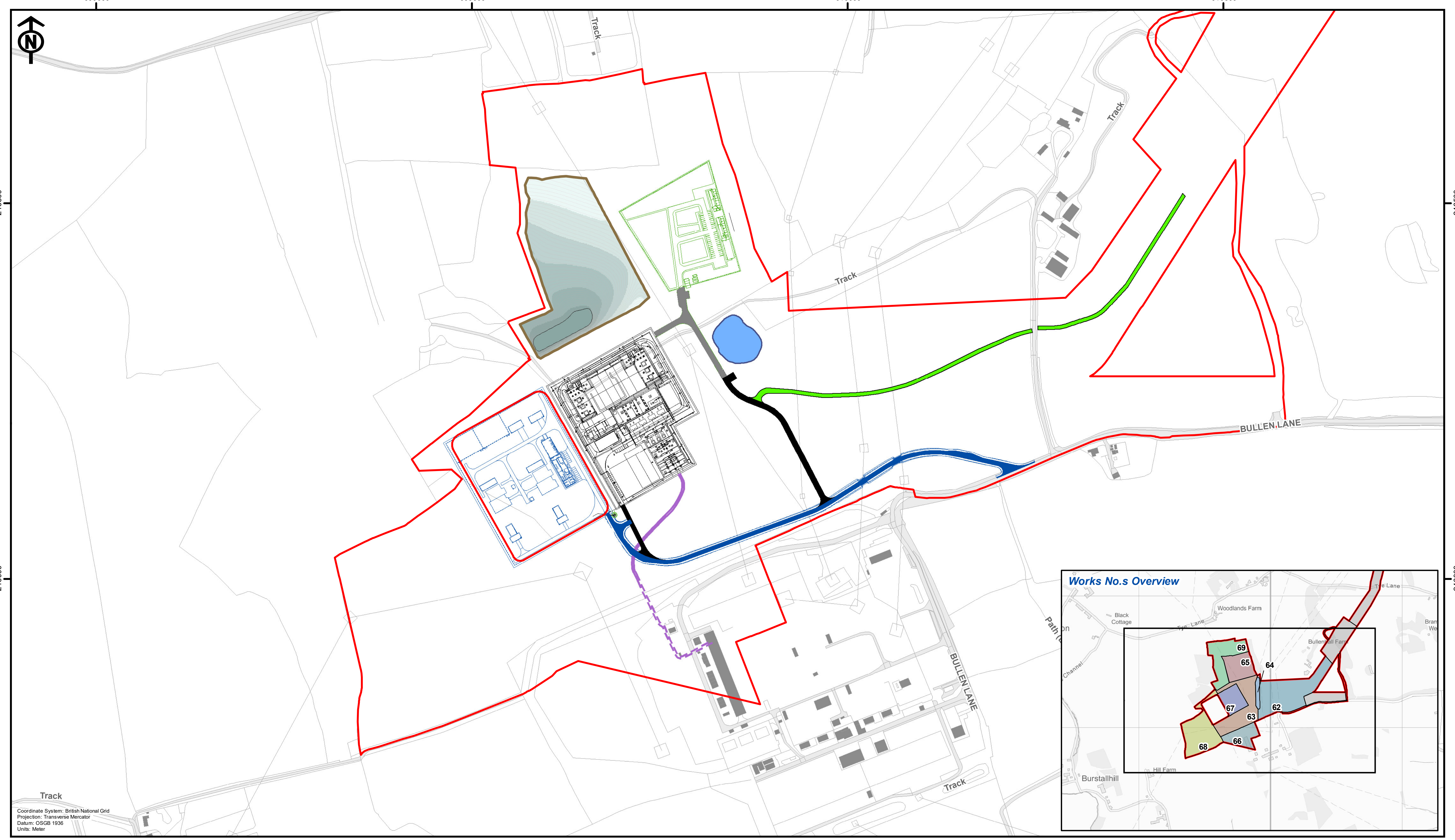
Drg No	05356.00006.12.00012.1 ONCS Ecological Sites
Rev	2
Date	14/04/2022
Layout	N/A

Document Path: P:\05356 - GoBe Consultants Ltd\00006 East Anglia Three\Tech\GIS\Dwgs\Wking\EA3\Onshore Substation\Doc Ref EA3-GRD-CON-PLN-IBR-000107\ONCS\5356.00006.12.12.1 Converter Station EA3 Ecological Sites.mxd

APPENDIX 6 SUDS POND DESIGNERS RISK ASSESSMENT

Hazard and Risk Assessment Review - East Anglia THREE Onshore Substation

					Harm to People			Environmental Effect				Harm to People			Environmental Effect					
Ref No.	Area of Concern (Location/System/Activity)	Hazard/Risk	Description of HAZARD & Foreseeable Risks	Project phase affected (Persons at Risk)	Without Controls	Without Controls	Without Controls	Without Controls	Without Controls	Without Controls	Proposed Mitigation/Control Measures	With Controls	With Controls	With Controls	With Controls	With Controls	With Controls	Residual Risk to be Managed	Action Owner	Further Actions required (HAZID Meeting actions)
					Severity S	Probability L	Result (S x L) RR	Severity S	Probability L	Result (S x L) RR		Severity S	Probability L	Result (S x L) FR	Severity S	Probability L	Result (S x L) FR			
							0													
1.08	SUDS pond	Excavation and construction works	Excavation works leading to working at height, Potential for fall from height and injury to personnel,	Construction team	Permanent Total Disability or upto 3 fatalities	Likely (10-60%)	16				Planned sequence of works, RAMS, work permits. Produce site operational proceedures.	Permanent Total Disability or upto 3	Unlikely (0.1-1%)	8				Working at height situations to be managed	**Site Construction Manager**	RAMS, Work permits,
1.09	SUDS pond	Excavation and construction works	Heavy machinery/vehicles such as Roller, excavator, etc used during construction. Misuse of machniery, fault machinery/vehicles, driver/operator fatigue could lead to accidents causing injury or fatality	Construction team	Permanent Total Disability or upto 3 fatalities	Likely (10-60%)	16				Planned sequence of works, RAMS, work permits. Produce site operational proceedures. Use approved machniery, Heavy machinery are inspected and maintained frequently training for operators before operating machinery Training for construction personnel on working around heavy machinery/vehicles Timely breaks for operators to avoid fatigue.	Permanent Total Disability or upto 3 fatalities	Very Unlikely (0-0.1%)	4				Handling of heavy vehicles/machinery and working around heavy vechicles	**Site Construction Manager**	Actions as per mitigation measures proposed please refer to column "Proposed Mitigation/Control Measures"
1.10	SUDS pond	Loose ground during construction	Excavation and storage of soil could potentially lead to loose ground in the construction area. Risk of susidence during construction and potential injury for construction personnel	Construction team	Major Injury or health effect	Possible (1-10%)	9				Planned sequence of works, RAMS, work permits. Manage using termporary works design, excavated soil to be compacted and stored, appropraite edge protection to be provided, area to be demarcated clearly	Major Injury or health effect	Very Unlikely (0-0.1%)	3				Working at height situations to be managed especially with soil storage on site	**Site Construction Manager**	Demarcations around the soil storage area
1.11	SUDS pond	subsidence risk	Risk of soil subsidence during the operation phase could reduce the depth of the pond potentially leading to permanent flooding outside	Maintenance team, Public	Minor Injury or health effect	Possible (1-10%)	6				SUDS pond profile is engineered, design accodance with UK standards and regulations Area not frequently accessible by the public Inspect and Maintain regularly	Minor Injury or health effect	Very Unlikely (0-0.1%)	2						
1.12	SUDS pond	Drowning risk	potential for drowning when people walking close to the edge	Construction and Maintenance team	Major Injury or health effect	Possible (1-10%)	9				Relatively low depth, also the pond is designed to have a gradual fall from the edge to the middle of the pond ensuring that there is no risk of sliding signage to be provided " no swimming or drinking" "drowing risk"	Major Injury or health effect	Very Unlikely (0-0.1%)	3				Drowning risk	**Design Engineer**	sign boards stating "drowing risk", "poor water quality, not for swimming"to be provided at the Suds pond
1.13	SUDS pond	Blockage of outlet	Bockage of outlet could lead to flooding and permanent higher water levels	Construction and Maintenance	Major Injury or health effect	Likely (10-60%)	12				Bigger outlet size considerd in the design (300mm dia pipe) regular inspection and monitoring of the outlet	Major Injury or health effect	Very Unlikely (0-0.1%)	3				Flooding risk during maintenance	**Maintenance Manager (EA3/OFTO)**	
1.14	SUDS pond	Dust from Construction activity	Dust arising (especially on dry weather conditions) from the construction activity will have impact on air quality in the sorrounding and subsequent impact on health for construction personnel and neary by residents	Health and Environmental HAZARD	Minor Injury or health effect	Very likely (>60%)	10	Minor Effect	Very likely (>60%)	10	Controlled excavation and soil management Regular monitoring of air quality at site Adopt regular water sprinkling if the dust is too high limit excavation and soil handling during heavy wind conditions	Minor Injury or health effect	Very Unlikely (0-0.1%)	2	Minor Effect	Very Unlikely (0-0.1%)	2	Construction dust	**Site Construction Manager**	Actions as mentioned in the mitigation measures, other measures as necessary for site specific conditions.
1.15	SUDS pond	Bio diversity hazard	Potential impact on the local bio diversity	Environmental HAZARD				Moderate Effect	Likely (10-60%)	12	Ecological survey is done and subsequent findings and reccomended measures by ecologist are followed for the contrcution of the pond. No major risks Post construction bio-diversity monitoring and survey will be done and measures will be implemeted as reccomended by the ecologist.				Moderate Effect	Very Unlikely (0-0.1%)	3	Bio diversity	**Civil Project Manager**	



EA THREE DCO Corridor

EA THREE Onshore Converter Station Layout Detail

EA THREE Onshore Converter Station Temporary Site Facilities Detail

EA THREE Converter Substation to National Grid Substation Cable Route

400kV AC Cable - Open Cut Section

400kV AC Cable - Ducted Section

EA THREE Onshore Converter Station Access Roads

Permanent

Temporary

EA THREE Cable Access Road

Haul Road

EA THREE Onshore Converter Station SUDs Pond

EA THREE Area to be Reprofiled

EA ONE Onshore Converter Station Access Road

Works No.s

62, 63, 64, 65, 66, 67, 68, 69

GoBe consultants

Rev	Date	By	Comment
B	04/04/2022	PW	Second Issue
A	31/03/2022	JRS	First Issue

Original A3 Plot Scale 1:5,000

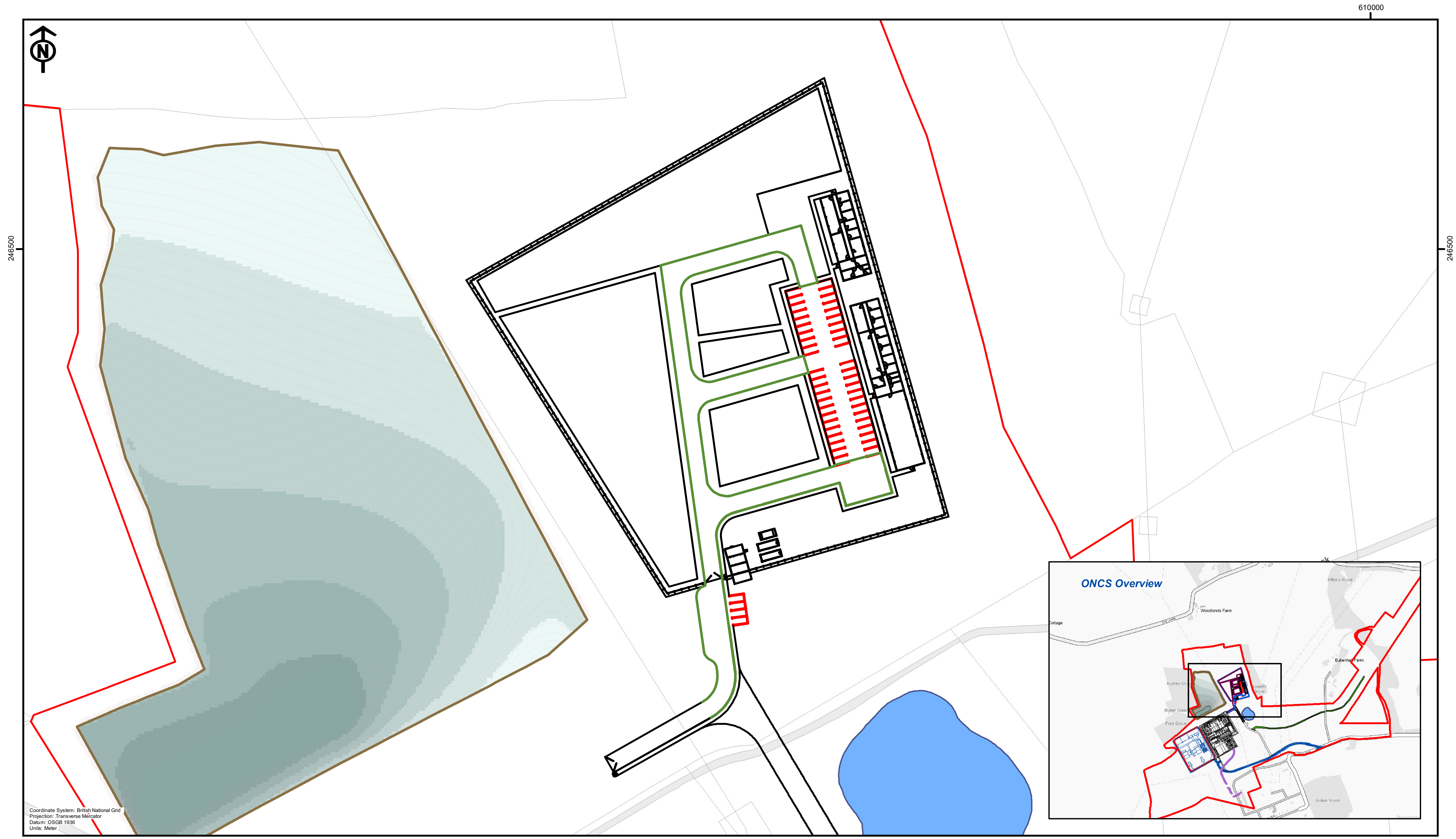
0 100 200 Metres

Onshore Converter Station Stage

Figure 1: Site Context Plan

Drg No	05356.00006.12.0001.1 ONCS Site Context Plan
Rev	2
Date	04/04/2022
Layout	N/A

Document Path: P:\05356 - GoBe Consultants Ltd\00006 East Anglia Three\Tech\GIS\Dwgs\Wking\EA3\Onshore Substation\ONCS and Commencement Master\5356.00006.12.0020.1 ONCS Site Context.mxd



- EA THREE DCO Corridor
- EA THREE Onshore Converter Station SUDs Pond
- EA THREE Area to be Reprofiled
- Temporary Site Facilties
- Proposed Gravel Access used during Construction
- Parking

GoBe consultants

Rev	Date	By	Comment
B	14/04/2022	PW	Second Issue
A	24/01/2022	PW	First Issue

Original A3 Plot Scale 1:1,250

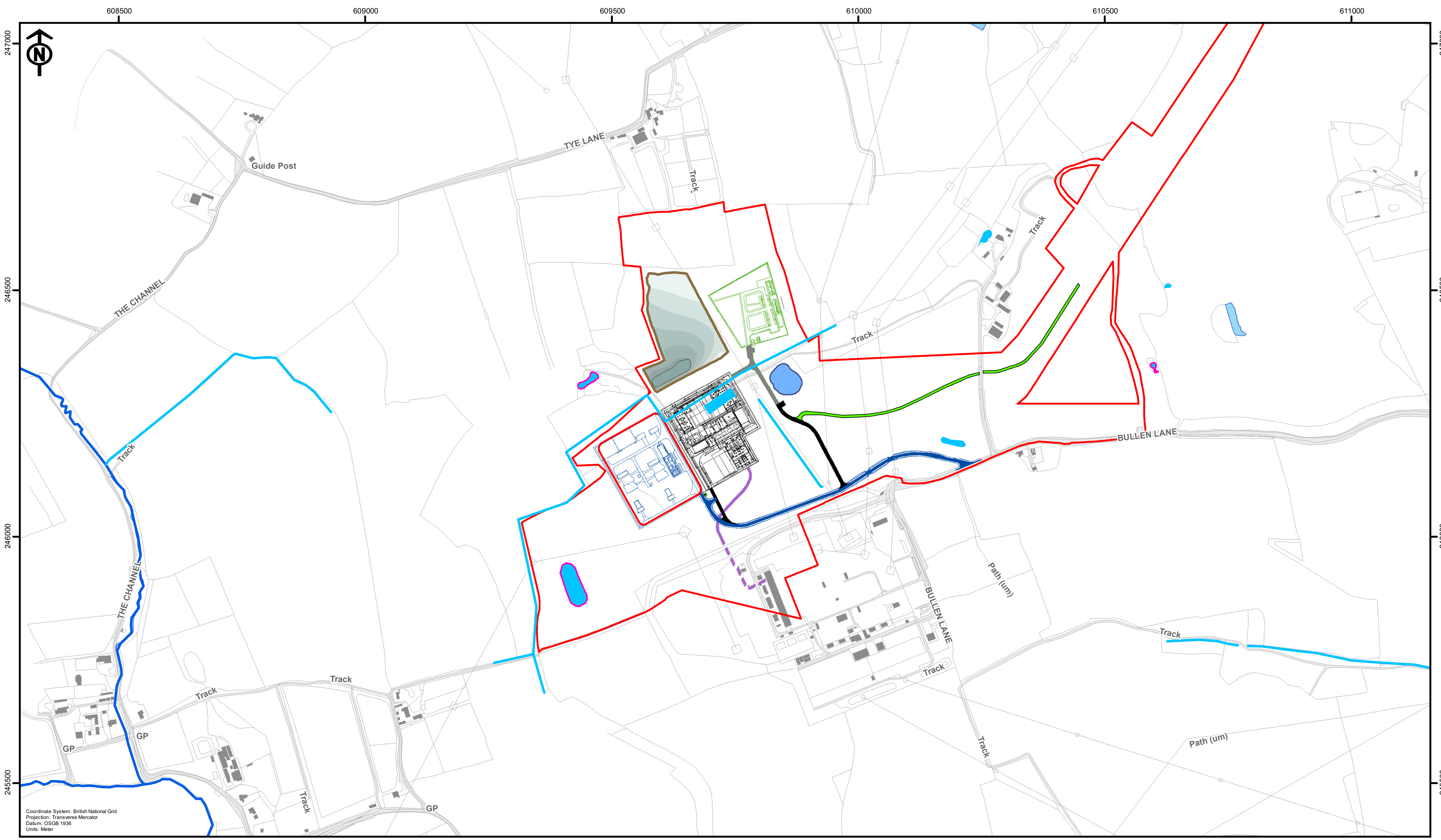
0 25 50 Metres

Onshore Converter Station Stage

Figure 2: Construction Site Plan

Drg No	05356.00006.12.00063.1 ONCS Construction Plan
Rev	2
Date	14/04/2022
Layout	N/A

Document Path: P:\05356 - GoBe Consultants Ltd\00006 East Anglia Three\Tech\GIS\Dwgs\Wking\EA3\Onshore Substation\Doc Ref EA3-GRD-CON-PLN-IBR-000107\ONCS\5356.00006.12.0074.1 Construction Site Plan.mxd



EA THREE DCO Corridor
EA THREE Onshore Converter Station Layout Detail
EA THREE Onshore Converter Station Temporary Site Facilities Detail

EA THREE Converter Substation to National Grid Substation Cable Route
400kV AC Cable - Open Cut Section
400kV AC Cable - Ducted Section

EA THREE Onshore Converter Station Access Roads
Permanent
Temporary

EA THREE Cable Access Road
Haul Road
EA THREE Onshore Converter Station SUDs Pond

EA THREE Area to be Reprofiled
EA ONE Onshore Converter Station Access Road
Statutory Main River
Surface Water Linear

Surface Water Area
GCN Positive Pond
GCN Negative Pond

GoBe consultants

Rev	Date	By	Comment
B	19/04/2022	PW	Second Issue
A	24/01/2022	PW	First Issue

Original A3 Plot Scale 1:7,500

0 140 280 Metres

Onshore Converter Station Stage

Figure 3: Surface Water Receptors

Drg No	05356.00006.12.0083.1 ONCS SW Receptors
Rev	2
Date	19/04/2022
Layout	N/A

Document Path: P:\05356 - GoBe Consultants Ltd\00006 East Anglia Three\Tech\GIS\Dwgs\Wking\EA3\Onshore Substation\Doc Ref EA3-GRD-CON-PLN-IBR-000107\ONCS\5356.00006.0083.10.1 ONCS Surface Water Receptors ONCS.mxd